Welding Engineer

AUGUST, 1959

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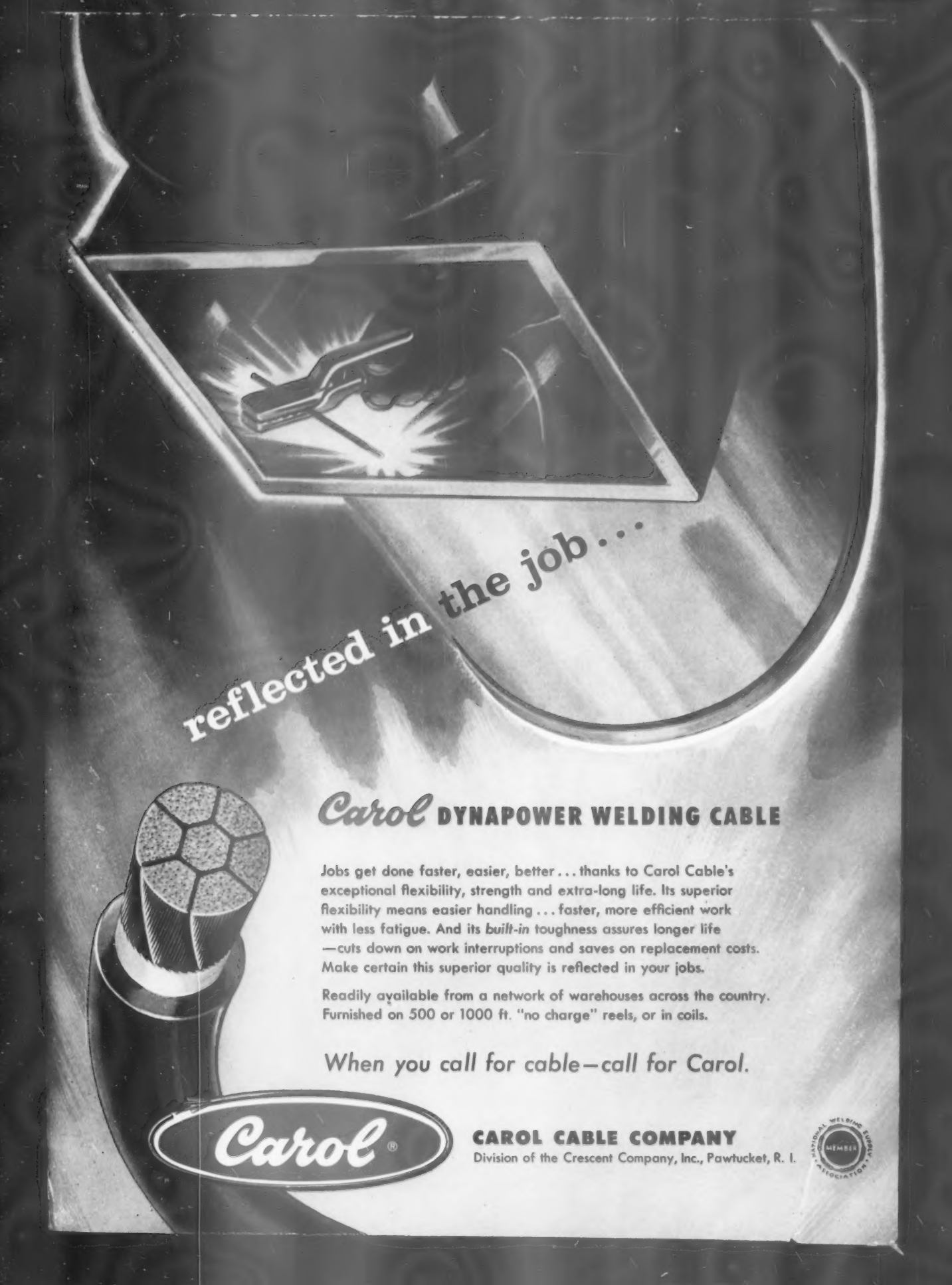
This welder shows some of the favorite tools of his trade: a Jackson insulated arc welding electrode holder, a Jackson ground clamp, and a Jackson welding helmet and safety cap. Sold by better welding supply dealers everywhere.



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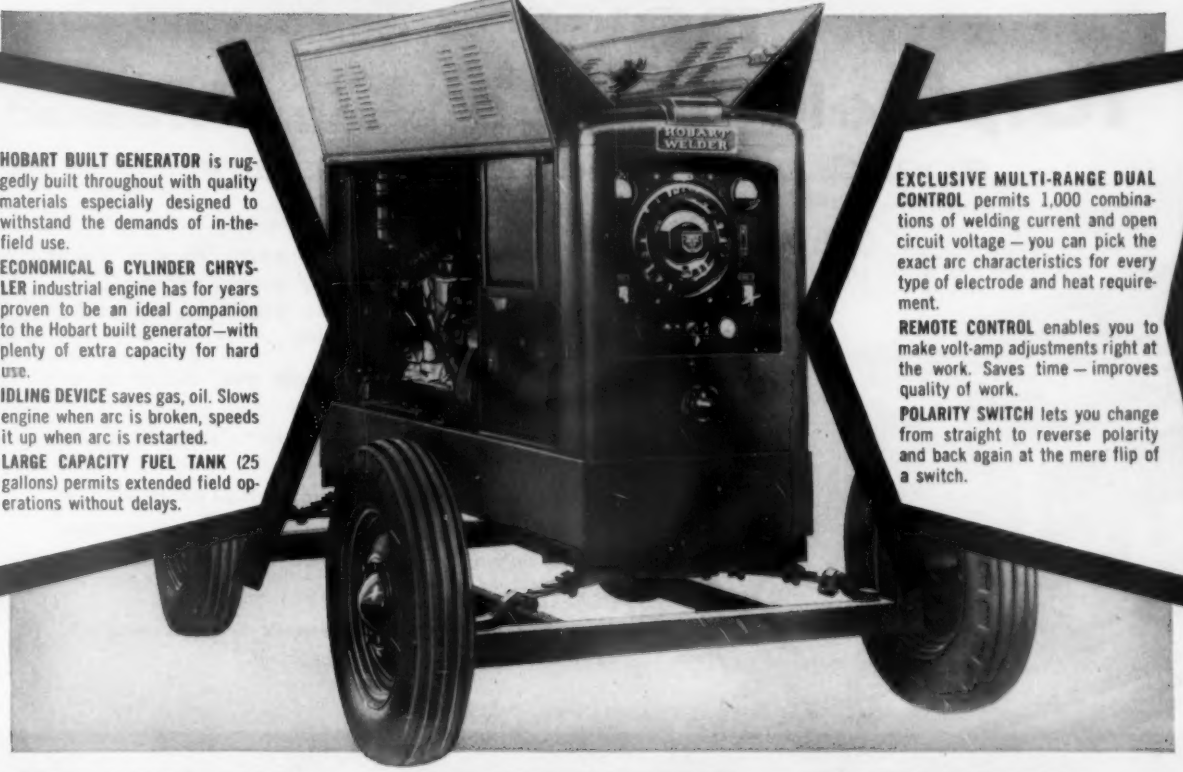

HOBART BUILT GENERATOR is ruggedly built throughout with quality materials especially designed to withstand the demands of in-the-field use.

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MORE DEPENDABLE!

Costly delays are eliminated—deadlines are met easily when this rugged Hobart welder is working for you. Superior materials, careful assembly and attention to details have made this welder famous around the world. No wonder it has been nicknamed "The work horse" by the metal working industry. Weldors everywhere have come to know and to depend on Hobart for top performance.

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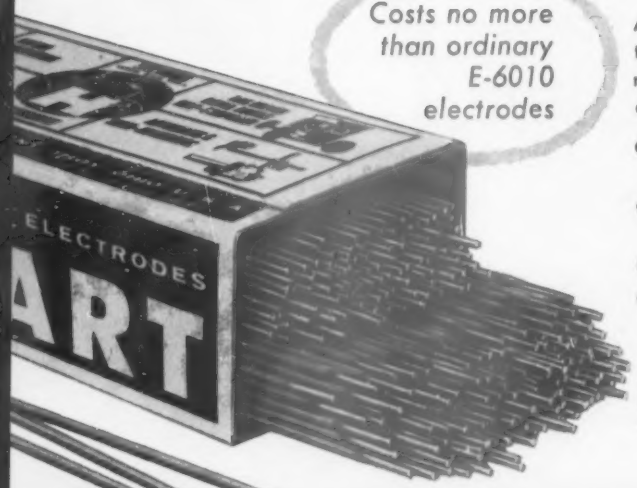

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Our work is _____

☐ Send catalog on complete line of welding electrodes.

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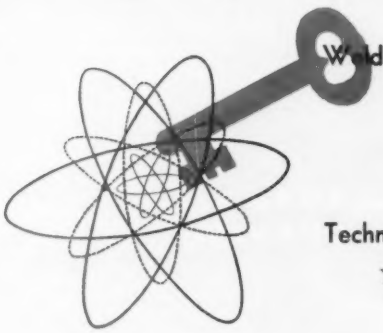
VOL. 44—No. 8

The magazine of joining and severing materials

Welding Engineer

This is welding: August, 1959



Welding—key for the door to nuclear reactors 27

The dome-like nuclear reactor containment-vessels cropping up around the country are fast becoming a familiar sight to most Americans. Designed to "contain" any nuclear explosion and its resulting contamination, the vessels require specially designed and constructed "doors" for entry and exit—hence, the all-welded cylinder-like air locks described here.

Techniques for torch brazing aluminum 30

★ When joining aluminum for particular applications, it may be more advisable to torch braze the components rather than to fusion weld them. Authors **Howard E. Adkins** and **Robert A. Ridout** enumerate and discuss the various techniques of this method. Less preheating, because of the lower working temperature, is the basis for the highly desirable production results.

How to get the most from semiautomatic welding machines 33

★ Maximum performance from a semiautomatic open-arc welder hinges on the observation of basic operation rules and a knowledge of the overall effect on deposition rates by changing variables. In this article, the three basic variables—wire feed rate, welding current, and length of exposed wire—are detailed and explained.

Welding figures prominently in 7-year plan 40

A literal translation from the Russian publication "Automatic Welding" gives an insight to the role welding is expected to play in the USSR's seven-year plan. One interesting point, equally apropos for American industry, is the scolding given various branches of Soviet industry for not adopting welding, and its cost- and weight-saving characteristics, on a more extensive scale.

★ Tear sheets of these two articles are available on request as long as the supply lasts.

Also in this issue:

Welding positioners aid manufacturer in jet production 29
Welded rail, concrete ties win German approval 36
Missile brazing time cut by new facility 45
Indians make use of vocational training program 50

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Capacity —
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225 amp. AC or DC, reduced duty cycle

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with long cap: 3.6 oz.

Length overall — 6⅞ in.

Length of Torch Head —
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with medium cap: 3-9/32 in.
with long cap: 7-5/16 in.

Maximum Handle Diameter — ¾ in.

Maximum Head Diameter — 9/16 in.

Service Lines — 12½ or 25 ft.

*Torch is supplied with medium cap for 3-in. electrodes. Short cap for 2-in. electrodes and long cap for 7-in. electrodes are available as accessories.

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Welding Engineer

America's pioneer publication which, combined with The Acetylene Journal, has been devoted to the interest of the welding and allied industries since 1898

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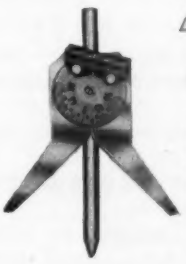

Really, 5 tools in one — it replaces Protractor, Centering Head, Center Punch, Level and Scale. Eliminates difficult measuring, checking and marking Pocket size—weight only 9 ozs.

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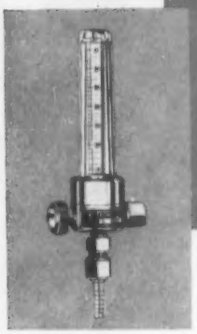

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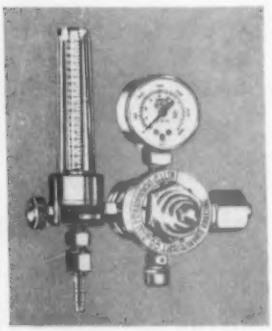
Victor regulators and flowmeters provide accurate, safe control and measurement of gases used in industrial applications, such as welding and cutting; gas shielded arc welding; laboratory work; atmosphere control; furnace operations, etc. For use with oxygen, air, argon, helium, nitrogen, hydrogen, carbon dioxide, and other gases.



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for regulators
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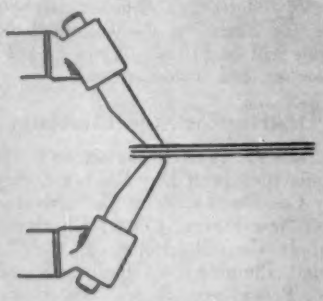
General Dynamics buys Hench gas enterprises

Liquid Carbonic Div., General Dynamics Corp., Chicago, has acquired the industrial and medical gas business of the Hench associated gas enterprises. With this move, Liquid Carbonic is entering the eastern section of the country for new industrial and medical gas markets, where it has not previously been active. Liquid Carbonic will for a short time continue to operate these Hench companies under their own corporate names, before consolidating them into Liquid Carbonic Div.

The leading Hench organizations, in the principal activity areas, are: New England Gas Products, Inc., Boston; American Oxygen Service Corp., Harrison, N. J.; Commercial Gas Corp., Wilkes-Barre, Pa.; Buckeye Oxygen Corp., Canton, Ohio; and Florida Gas & Chemical Corp., Dania, Fla.

LaVerne W. Hench began his enterprises at Canton, Ohio, in 1923, with a small oxygen plant, and during the ensuing years growth was financed entirely from within the organization. The sale of Hench enterprises is a preliminary step to retirement for Hench. He will continue as a consultant to Liquid Carbonic.

WELDING is speeding erection of 800 tons of structural steel and 400 tons of steel bar joists for this new apartment building in Cleveland. Building covers 212,000-sq-ft, and is 10 stories high. Weldor is shown at work on sixth story. Builder's Structural Steel Co. is doing work, using E6010 electrodes on all welds. Machines shown in foreground are Hobart Bros. Co. welders.



Next month . . .

Spot welding procedures and design
This is the first of a series

How to get better stainless steel welds
The science of welding stainless steel is discussed

Understanding weld distortion and shrinkage
Article shows importance of weld heat in determining cause of weld distortion

The September WELDING ENGINEER will also include other articles, and the regular departments, designed with you, the reader, in mind.

AEC to conduct radioisotope symposium

The U. S. Atomic Energy Commission, in cooperation with the Buffalo Chamber of Commerce, University of Buffalo and Canisius College, will sponsor a two-day symposium on industrial uses of radioisotopes in Buffalo, N. Y., August 20 and 21.

Purpose of the meeting is to introduce industry to the many industrial applications of radioisotopes and to increase awareness of the versatility and industrial opportunities provided by these nuclear tools.

Representatives from industry will review the economic implications of radioisotopes and discuss improvement in production and efficiency obtained by their use in gaging, radiography and industrial tracing.

Commission speakers will detail government programs of cooperation with industry and education in encouraging increased applications of profitable radioisotope techniques. A series of brief experience reports by industrial users in various process industries will be presented.

In another effort to increase their use, the AEC will begin a program this fall which will provide students of small undergraduate colleges with the opportunity for specialized training in the techniques of using radioisotopes.

A 35-ft mobile laboratory will move from campus to campus, presenting a two-week course on basic handling techniques.

Scientists and technicians from the Oak Ridge Institute of Nuclear Studies, which will conduct the program for the Commission, will accompany the mobile laboratory to lecture and conduct experiments.

Cox, Mullen elected officers of RWAA

James C. Cox was elected president, and H. A. Mullen, vice president, of the Resistance Welding Alloys Association at its recent third annual meeting held at the Detroit Yacht Club. Cox succeeds J. A. O'Grady of Weldaloy Products Co., Van Dyke, Mich.

Cox is president of the S-M-S Corp. of Detroit, and is chairman of the Association's Standards Committee. He is a member of the American Standards Association, the American Welding Society, and the Engineering Society of Detroit.

Mullen is manager of the Resistance Welding Dept. of Ampco Metal Inc., Milwaukee. He is a member of the AWS and the American Society for Metals.

Picker X-Ray Corporation opens research center

The new $1,000,000 research center, built by Picker X-Ray Corp. at Cleveland, was recently dedicated by Dr. Paul C. Aebersold, director of Isotopes Development for the Atomic Energy Commission.

"The use of radioisotopes has the potential to save U. S. industry billions of dollars per year" said Dr. Aebersold in the course of his address.

As described by Picker officials, the new Research Center is one of the most completely equipped radioisotope laboratories in the nation for commercial use and possibly the largest isotope encapsulation point for industrial and medical users.

New oxygen storage tank at San Francisco

A new storage and distribution installation to supply gaseous oxygen for shape-cutting of steel was recently put in operation at the Earle M. Jorgensen Co.'s steel warehouse in San Francisco. It is the first of its kind for industrial applications in that city.

The unit, manufactured by Linde Co., New York City, consists of one vacuum-insulated tank, which stores the gaseous equivalent of 25,000 cu ft of oxygen in liquid form at 300 deg below zero. It automatically converts liquid oxygen to a gas and delivers it at controlled pressures to Jorgenson's oxy-natural gas cutting machines.

COMING EVENTS

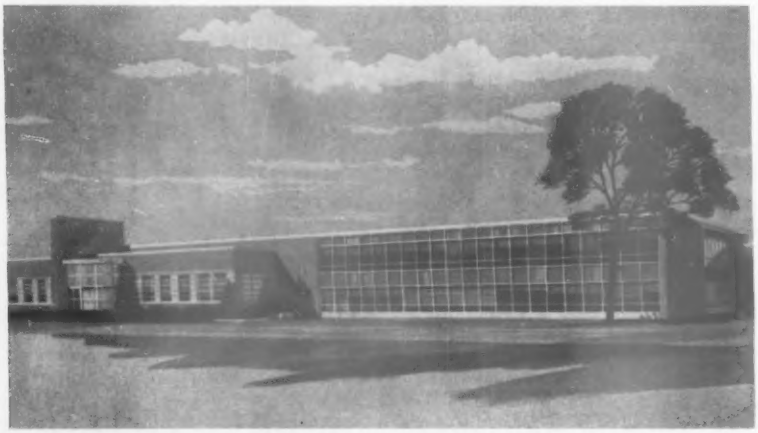
SEPT. 24-25: NWSA Central Zone Meeting, Statler Hilton Hotel, Detroit.
SEPT. 28-29: NWSA Eastern Zone Meeting, Hotel Roosevelt, New York City.
SEPT. 28-OCT. 1: National Fall Meeting of the AWS, Sheraton-Cadillac Hotel, Detroit.
OCT. 19-20: NWSA West Central Zone Meeting, Pick-Nicolett Hotel, Minneapolis.
OCT. 22-23: NWSA Western Zone Meeting, Riviera Hotel, Las Vegas.
NOV. 2-6: 41st National Metal Exposition and Congress, International Amphitheatre, Chicago.
NOV. 30-DEC. 1: NWSA Southeastern Zone Meeting, Atlanta Biltmore Hotel, Atlanta.
DEC. 3-4: NWSA Southwestern Zone Meeting, Hotel Texas, Forth Worth.

Machine Design Award jury members now active

Chairman Dr. E. E. Dreese of The James F. Lincoln Arc Welding Foundation states that members of the jury of award for the Foundation's $50,000 Machine Design award program are meeting at Alanson, Mich., during August. The competition closed July 20.

These men compose the jury, which is selecting the award designs best illustrating the advantages of welded steel design as applied to machinery of all types: Frank Gleve, assistant chief engineer, United Engineering and Foundry Co., Pittsburgh; A. R. Holowenko, professor of mechanical engineering, Purdue University, Lafayette, Ind.; Gordon M. Sommer, vice president of engineering, Clearing Machine Co., Chicago.

Amperex building new engineering wing



AMPEREX Electronic Corp., Hicksville, Long Island, N. Y., has started construction of a new, two-story, air-conditioned engineering wing to be added to the present Amperex facility. Pictured is artist's conception of addition, slated for completion in October. New wing will add 13,000-sq-ft of working space to the 100,000-sq-ft of present building. Amperex is a manufacturer of resistance welding and other types of electronic tubes.

Chicago AWS section offers lecture series

The second Annual Lecture Series of the Chicago section of the American Welding Society will take place in the Dome of the Chicago Bridge & Iron Co., 332 S. Michigan Ave., Chicago. The general subject will be Practical Welding Metallurgy II.

On Sept. 17 and 24, Richard Lee of Alloy Rods Co., York, Pa., will discuss "Welding of low alloy steels". On Oct. 1 and 8, Wayne Wilcox of Arcos Corp., Philadelphia, will speak on "Welding of stainless steel". On Oct. 15, Fred Baysinger of Kaiser Aluminum & Chemical Corp., Spokane, will discuss "Welding of aluminum alloys".

Robert Oller, Commonwealth Edison Co., is chairman of the committee which planned the program.

AWS national meeting starts in Detroit, Sept. 28

The American Welding Society's National Fall Meeting will take place at the Sheraton-Cadillac Hotel, Detroit, beginning on Sept. 28 and running through Oct. 1.

In addition to the 16 technical sessions, separate conferences, a banquet, plant tours, and a four-day ladies' program are all included in the program.

An inflationary note: registration fee for attending the technical sessions will be $10 if you are an AWS member, $15 if you are not.

Distributor appointments

Tube Turns Div., Chemetron Corp., Louisville: John Day Rubber & Supply Co., Omaha, Neb.; C. S. Mersick Co., New Haven, Conn.; Charleston Supply Co., Charleston, S. C.; National Plumbing & Heating Supply Co., Providence, R. I.; New Hampshire Supply Co., Manchester, N. H.; Raritan Supply Co., Nixon, N. J.

All-State Welding Alloys Co., White Plains, N. Y.: Elyria Supplies Co., Elyria, Ohio; The Balbach Co., Des Moines; Lima Welding Supply Co., Lima, Ohio; Magnolia Welding Supply Co., Pascagoula, Miss.

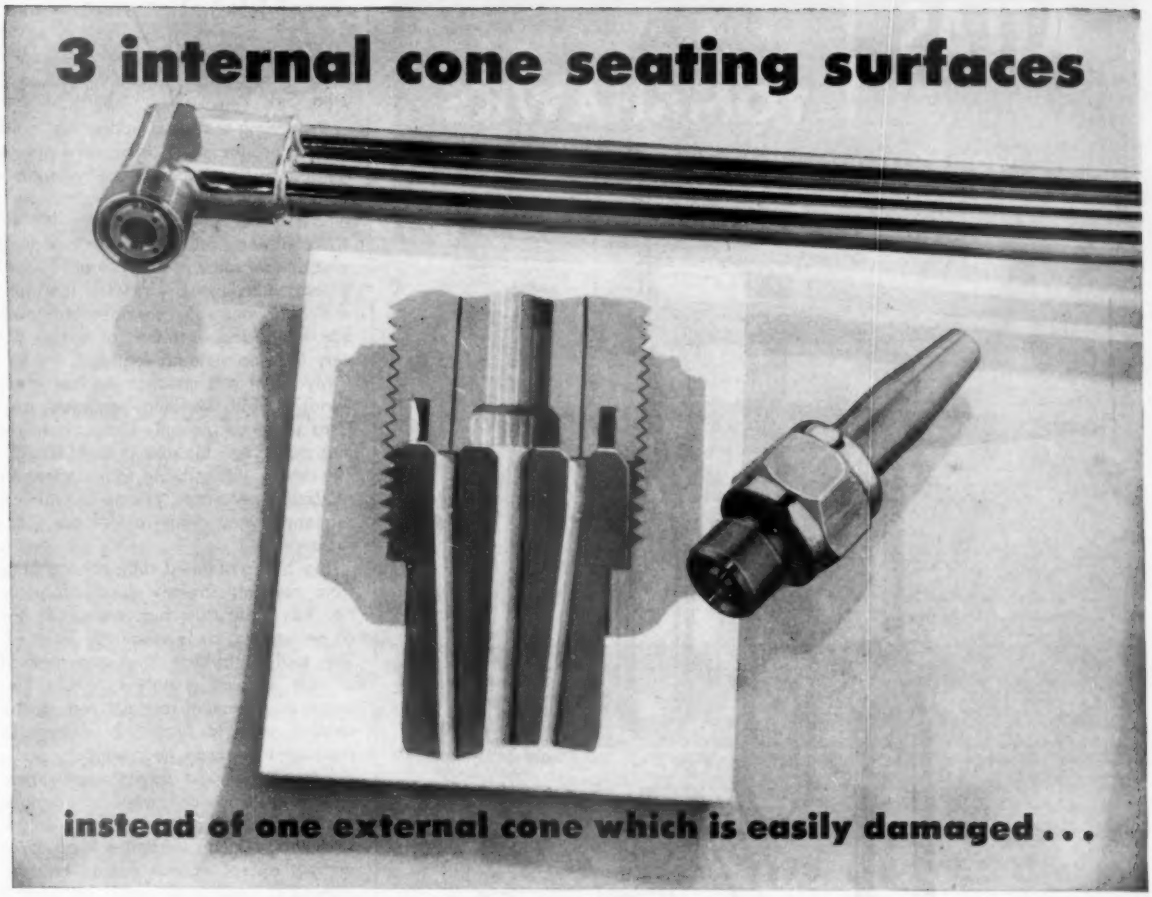
A. M. Byers Co., Pittsburgh: Shultz Steel Co., South Gate, Calif.; Schill Steel Co., Houston, Tex.; Tech Steel & Alloy Corp., Chicago; International Steel Corp., Hillside, N. J.; A. Milne & Co., Inc., New York City.

Millers Falls Co., Greenfield, Mass.: Kessler Sales & Service, Richland, Iowa.

Harnischfeger Corp., Milwaukee: Arizona Products & Machine Co., Phoenix.

(Additional news on page 53)

3 internal cone seating surfaces



instead of one external cone which is easily damaged . . .

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external cone — easily damaged

internal cones — well protected

Internally opposing conical seat surfaces are protected against external damage and they permit complete reconditioning by swaging—a process which, on other type tips, might close up all ports. Conical surfaces on the inside—as against outside seating surfaces make all the difference—to tip life—and to your pocketbook.

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WITH "WIDE BLADE" THAT SPEEDS THE JOB

This is our economy tool—yet it has all these famous Atlas features: (1) Forged head of chisel steel with 18% wider blade for faster work with less effort. (2) Head can't come off or turn on shaft. (3) One piece steel shaft and grip that can't burn or splinter and lasts as long as the head . . . You'll like both the "feel" and balance of this husky, quality Atlas Tomahawk and you'll like the price, too! It is available in three models: cross chisel and cone, chisel and cross chisel, chisel and cone. At the price, you can own the set of three and be prepared for any job that comes along.

Tough as they come!

33 MODELS

Each Atlas tool is made as well as we know how. Ask your welding supply dealer to show you the complete line.

ATLAS

WELDING ACCESSORIES

INCORPORATED

707 E. LEWISTON

FERNDALE 20, MICH.

Letters . . .

In answer

Dear Sir: Seattle, Wash.

Regarding the letter appearing in the June issue, the short article was not intended to be a complete development of welded joint design.

We are in complete accord on the six considerations listed as being of great importance in analysis of residual stresses. I believe a survey of literature will bear out that considerable work has been done on five of these, yet very little on welding sequence.

My intent was not that residual stress variation with welding sequence patterns stand as the only factor, but that it is most often ignored in weld design. The article was to bring to the attention of design personnel, effects of welding sequence when other factors are satisfactory.

The observation of difficulties arising from residual stresses during fabrication are quite true, but restraint is not as detrimental as is seemingly inferred. The well-established back-step method of butt welding is only successful because of maximum restraint forcing the cooling weld to plastically deform to conform to desired geometry.

I think the most advantageous procedure is to weld toward restraint to preserve desired geometry. Do not construe this to mean it applies in all cases without exception. But it may be considered a basic philosophy for joining structures without aid of fixture or stress relief.

I hope I may contribute some small amount to clarification of the role of welding sequence as an engineering function. Observation of local and some limited number of national fabricators indicates this important phase of welding is all too often delegated to the shop.

There is a definite need to establish weld sequences that will give dimensional integrity to structures without any costly stress relief.

Richard E. Holt
Assistant Professor
University of Washington

[Ed. note—In answer to the question of a possible 30% of design load causing a permanent sag of several inches in a beam, Professor Holt has prepared a second article which will appear in the September WE.]

Judge for yourself

Sir: Taft, Calif.

We certainly like your yellow news page. But are you sometimes too fast to be accurate? We are wondering just

how many people attended the Welding Show in Chicago. On your yellow page in May, and the show story in June, you said the show registration was just under the record. Other welding magazines say it broke the record. Who is right?

Bill Halloway

—While one magazine reported the Chicago AWS Show attendance at "close to 15,000", and another says "record breaking attendance of 11,241", we still say "just under the record". According to AWS Show registration figures—12 more people signed in at the 1957 Philadelphia Show. There, the total was 11,253.

We like your attitude

Sir: Pasadena, Calif.

Herewith is a letter from our Congressman, which is self-explanatory. Thought you might like to know his comments on your recent editorial. (See WE, May 1959, p. 25).

Dear Mr. Archer:

Many thanks for that editorial from the *Welding Engineer*. It's most effective. May I suggest that you and your friends write their Eastern friends to write to their own Congressmen. Certainly, we need all the help we can get to "hold the line" on these wild spending bills.

I greatly appreciate your sentiments and your support.

(signed)
Edgar W. Hiestand, M.C.

I feel that I am an old member of the *Welding Engineer* family. During most of the thirties, I was exclusive representative for them on the Pacific Coast—circulation, advertising, staff writer, and news reporter.

W. E. Archer

Anniversary greetings

Sir: Memphis, Tenn.

. . . Mr. Jefferson, hearty congratulations on the 60th anniversary of your magazine.

We wish you the very best in your 61st year and all the years that will follow.

Abe Sauer
Tennessee Fabricating Co.

Pipeline pioneer

Sir: Bartlesville, Okla.

It was very considerate of you . . . and I certainly appreciate the credit you gave our company for pioneering the electric welding of pipelines [in the May issue].

Harold C. Price
H. C. Price Co.

A LEADER
for over 40 years . . .

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- Variable tip pressure—0 to 1000 lbs. in seconds
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For additional information, ask your jobber or write: The Merit Company, 2124 W. Chicago Ave., Chicago 22, Ill.

Sold through jobbers only
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SPOT WELDER DIVISION
THE MERIT COMPANY
2124 W. Chicago Avenue
Chicago 22, Illinois

The clad material in this process vessel is 304 on A 285 Grade C plate. Arcaloy 309 Lime electrodes were used for the entire joint on all girth seams because of variances in the thickness of the plate material.

Approximately 1200 pounds of Arcaloy 309 Lime electrodes were used for seam joints and nozzle fittings on each vessel.

Critical welds demand the quality of

ARCALOY

STAINLESS STEEL ELECTRODES

Stainless steel or stainless clad material is used on critical applications for its corrosion resistance and high strength properties. The nation's leading fabricators specify Arcaloy stainless steel electrodes to retain these properties and to safeguard their reputation.

Colonial Iron Works, Cleveland, Ohio, has relied on Arcaloy electrodes for many years because they produce the quality of weld metal required for critical stainless welds. They know that they can depend on this quality always and in any of the more than thirty different analyses of stainless electrodes made by Alloy Rods Company. They also know that their distributor, Scott-Tarbell, Inc., can meet their needs with "always fresh" electrodes, because they are hermetically packaged in metal to safeguard freshness and quality.

Your Alloy Rods Company representative or distributor has the knowledge and products to meet your stainless steel welding requirements. Give him a call or write direct requesting Bulletin AR-102. Alloy Rods Company, P. O. Box 1828, York, Penna.

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NO FINER ELECTRODES MADE . . . ANYWHERE

Phelps Dodge Habirprene* Arc Welding Cable

lasts longer under roughest working conditions!

The durable quality of Phelps Dodge Habirprene arc welding cable makes it ideal for use on jobs where welding cable undergoes severe physical wear and tear. Records show that Habirprene cable more readily absorbs heavy blows and weights, resists oxidation and damage caused by severe working conditions in shipyards, oil refineries, building construction and boiler-making plants. In some applications, Habirprene cable has lasted many times longer than rubber cable.

More than 10 years ago, Phelps Dodge pioneered Habirprene welding cable—the first real advance in this field. Today's Habirprene welding cable is the result of Phelps Dodge development and manufacturing experience devoted over the years to providing an arc welding cable of superior quality with a proven record for safety, dependability and long life. This cable meets all requirements of A.S.T.M. D752.

See your authorized Phelps Dodge distributor for hard-wearing, long-lasting Habirprene arc welding cable with indelible gold markings. Phelps Dodge also makes a full line of rubber arc welding cable and welding power supply cable. All these cables are available from stock.

*NEOPRENE

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SALES OFFICES: Atlanta, Birmingham, Ala., Cambridge, Mass., Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Dayton, Denver, Detroit, Fort Wayne, Greensboro, N.C., Houston, Indianapolis, Jacksonville, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle, Washington, D.C.

Weld anywhere with P&H portable welders!

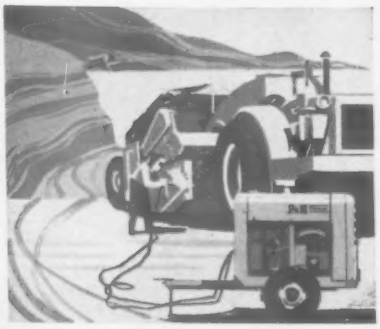
5 engine-driven models enable you to match your needs for construction, pipeline, maintenance, and repair welding in the 25- to 500-amp range

If you use portable welders, you haven't looked at the field until you've seen the new, broad P&H line. Five different models give you a wide choice of sizes to meet your needs and your pocketbook. Easy, precise voltage control and superior current and arc stability enable operators to lay down sounder, cleaner welds faster — prevent burn-through and popouts. The results: fewer rewelds and no costly call-backs.

The rugged, compact P&H welders are built to withstand the heavy use and rough handling on field jobs. They need less care — and they are easier to service. Powerful engines deliver power to spare — with gas-miser economy. A dependable idling control automatically slows the engine down to idling speed when not welding — saves gas and oil, cuts wear.

P&H engine-driven welders come skid- or wheel-mounted — with manual or 6-volt electric starting. For information, write Dept. 308A, Harnischfeger Corp., Milwaukee 46, Wis.

P&H HARNISCHFEGER
WELDERS • ELECTRODES • POSITIONERS



HERE ARE THE FIVE P&H SIZES!

WN-180
Handy, low-cost DC welder fo shop and field work in the 25- t 200-amp range.

WNG-200
Compact, light-weight portabl for heavy-duty DC welding rang ing from 40 to 250 amps.

WNG-300
This rugged middleweight an swers your need for trouble-fre welding in the 60- to 375-am class.

WNG-400
Here's cost-cutting DC wel power for the big jobs requirin 80 to 500 amps.

WND-303
This is a diesel-powered new comer to the P&H line. Unit ha a welding range of 60 to 375 amp

WELDING ENGINEER

Your August, 1959

Weld World

As WE went to press, these were the industry's latest developments:

. . Price increases are due in several industries . . . one industrial X-ray film producer hiked your costs about 4½%. Others should soon follow suit. Aluminum prices are expected to go up, even if current labor talks do not result in wage boosts. Most contracts were to end July 31.

. . Recovery in welding-equipment manufacturing industry continues apace. Resistance Welder Manufacturer's Association reports 42% gain in net orders for first five months of this year over similar period in 1958.

. . Titan Metal Mfg. Co., Bellefonte, Pa., which produces bronze welding rods (among other products), has been merged into Cerro de Pasco Corp., New York City, as a division. It formerly was a subsidiary. Present management will continue.

. . Resistance Welding Alloy Association's standards committee is revising the numbering system for electrodes and electrode holders, which will result in a more logical and comprehensive means of designating tapers. But it will not mean any changes in current taper dimensions

. . Oxygen manufacturers are encountering competition in the steel industry—Wheeling Steel Corp., Wheeling, W. Va., and Hydrocarbon Research, Inc., New York City, are forming a jointly-owned concern, Mingo Oxygen Co., to build and operate a 400-ton-per-day oxygen generating plant at Mingo Junction, Ohio. Reputed cost: $6 million.

. . Alloyd Research Corp., Watertown, Mass., has developed a method for depositing dense coatings of chromium, molybdenum and tungsten on various metals. Potential applications: in electronics and missile industries, and as a possible substitute for stainless in chemical, food and dairy industries. Process is similar to vacuum metallizing.

. . Caracas, Venezuela, is the site of a new electrode-manufacturing plant to be built by Oerlikon Corp. of Switzerland. In another recent move, the machine-tool firm (which is also in the missile field) sold its Asheville, N. C., plant to Celanese Corp. of America. The site includes research and development facilities, as well as production equipment for high-energy fuels and propulsion units. The plant will be operated by Amcel Propulsion, Inc., a firm in which Celanese will have controlling interest.

. . Though not officially confirmed at this writing, a report has the Carrier Corp. selling its Cambridge Co. division, Lowell, Mass., to fabricator of steel containers. Cambridge is a leading producer of liquid-oxygen and similar tanks.

. . A joint program to develop improved steels for use in nuclear-power reactors has been undertaken by U. S. Steel Corp. and General Electric Co. It constitutes the first large-scale investigation of radiation effects on steels carried out in a private test reactor and wholly financed by private industry.

use Airco's new Dip Transfer† *CO_2 Process***

for **ALL-POSITION WELDING OF STEEL IN ALL THICKNESSES**

low costs · easy fit up · high speed · very low spatter · no warpage

In welding mild sheet steel manually, there's only *one way to reduce costs and produce high quality welds* at the same time. Airco Dip Transfer CO_2 Process Welding. Let's be specific: –

- The complete Airco Dip Transfer CO_2 package welds in all positions . . . manually!
- Welds are hydrogen-free.
- Virtually ends warpage – only low average currents are used for burn off.
- Creates little or no spatter.
- Handles typical steel joint fit ups.
- No flux needed.
- Penetrates deeply – critical for high quality.
- Welds much faster than flux-based processes.
- Uses money-saving Pureco CO_2 as shielding gas.
- The basic equipment welds all weldable metals.

The Airco Dip Transfer CO_2 Process gives you consistently *high quality* welds at *lower costs* than any other process. For complete information, phone or write your nearest Air Reduction Representative. Ask for the new 24-page "AIRCOMATIC CO_2 WELDING" Catalog.

Pureco CO_2 is supplied by the Pure Carbonic Company, a division of Air Reduction Company, Incorporated.
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For 27 Years Preferred By Welders

THE DURO "STANDARD"

- All Parts quickly replaced with a screwdriver
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Featuring "Long Jaw design" for reaching those "hard to get at places"

The New Duro "DUROGON" Tong-Type

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- All Parts quickly replaced with a screwdriver
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DURO

ENGINEERING COMPANY · 31 OREGON AVE. · HAMDEN, CONN.

How Claude Phillips helped

More than ten years experience as a welding specialist gave Claude Phillips a sound basic knowledge of metallurgy and grinding methods. In the years since World War II, he has expanded that knowledge into an expert's familiarity with all types of grinding techniques. It is this wide yet concentrated experience that makes him so outstandingly useful to his customers.

cut stainless steel weld-grinding costs

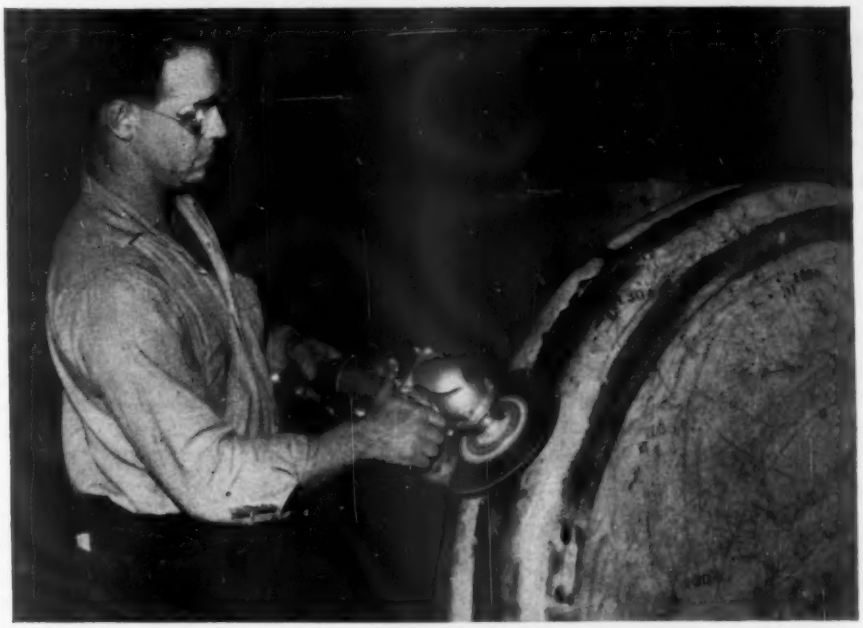
There's nothing delicate about stainless steel until you overheat it. Then you've got a problem... because excessive heat breaks down the chemical structure of the metal and reduces its resistance to corrosion.

Nobody is more conscious of this than Plant Manager John Luker of Gaston County Dyeing Machine Co., Stanley, N. C., and the man who helped him solve the problem... Claude Phillips of Bay State distributor Southern Oxygen Company.

Knowing the job that Bay State Blue Flash R grade wheels had been doing for others, Phillips persuaded Luker and Purchasing Agent James Stroup to try them. They not only cut cool... comfortably below the 670°F critical limit of stainless... they gave him a higher rate of stock removal than any other wheel on the market. As a result, more work is produced per payroll dollar and there are neither hot spots nor weak spots in Gaston County Dyeing machines.

Like Claude Phillips, your own Bay State distributor is an experienced specialist in grinding problems. Cost-cutting ideas he develops for others may be unexpectedly useful to you, too. Why not get in touch with him and see what he can do? *Better grinding at lower cost—that is his business.*

Operator uses 9" x 1/8" Blue Flash R grade raised hub disc wheel to blend pressure tank of T-316 stainless. This wheel generates minimum heat yet gives extremely high rate of stock removal.

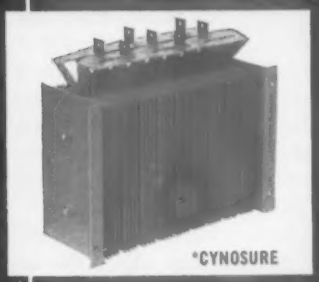


BAY STATE WHEELS of PROGRESS

BAY STATE ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh. *Distributors:* All principal cities.

THIS HELPS MAKE THE DIFFERENCE



*CYNOSURE

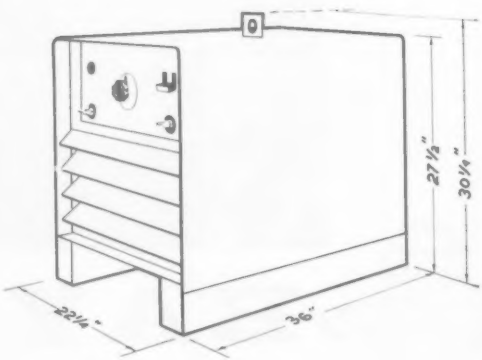
THAT MAKES the Miller GOLD STAR SR the GREATEST . . .

. . . rectifier type welder ever created!

Small illustration above shows the Miller-designed, Miller-built semi-metallic rectifier stack that combines with a new transformer and new weld stabilized circuit to set the Gold Star SR line of welders above and apart from all others; that has earned for them the reputation among professional weldors of being the world's best performing, longest lasting machines of their type.

Built to withstand the most demanding industrial d-c welding applications, including carbon arc service, this series is available in four basic models with 60% duty cycle ratings of 200, 300, 400 and 600 amperes. Duplex models to 1200 amperes. Shown to right is line drawing of the "horizontal" model for use where space is limited, or for outdoor use.

Complete particulars will be sent promptly, or a demonstration by your local distributor will be arranged at your convenience.



miller ELECTRIC MANUFACTURING COMPANY, INC.
APPLETON, WISCONSIN

Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal
EXPORT OFFICE: 250 West 57th St., New York 19, N. Y.

*CYNOSURE: Anything to which attention is strongly turned; a center of attraction.

BETWEEN PASSES

new materials

The feasibility of making a new class of metallic materials has been demonstrated in research at Battelle Memorial Institute, Columbus, Ohio. Sponsored by the Lead Industries Association, the research involved mixing molten lead with finely divided particles of other metals or materials. The result: lead-cemented alloys combining properties of both lead and the second substance—usually a metal.

Battelle investigators found that at least six metals are particularly suited for "leading"—cobalt, copper, iron, molybdenum, nickel and tungsten. The corrosion resistance of lead, plus increased strength gained from other metals, suggests that some alloys might be useful in the chemical and similar industries requiring such materials.

hot money

"A $12,500 heat of steel."

That's what steelworkers called use of 1,250,000 steel pennies in making steel at an eastern Pennsylvania plant recently, according to the American Iron and Steel Institute. The coins had been condemned by the U. S. Treasury and were sealed in metal containers. Although you still see some of them around, the zinc-coated steel pennies are gradually being withdrawn from circulation and going back to make steel for other uses.

During 1943, they were the only pennies minted, in an effort to conserve copper.

USS Enterprise

Only last month, *WE* depicted the scrapping of the *USS Enterprise*, famed aircraft carrier of World War II. But its tradition is not being scrapped. The U. S. Navy is giving that honored name to the world's first nuclear-powered carrier.

To give you an idea of the size of a nuclear power plant needed for the huge ship . . . the closure head flange weighs 74,000 lb and the top disc weighs 36,750 lb. These tremendous components are for one of eight reactor vessels. The top disc will be seated inside the flange and both parts will be welded to other sections to form a single reactor vessel. They are made from a nickel-chrome-moly alloy steel.

the engineer

In an attempt to create desirable understanding of engineers and engineering by various media, Engineers Joint Council has instituted an advertising program in *Editor & Publisher*, the newspaper profession's WELDING ENGINEER. Theme of the series: *scientists make it known, but engineers make it work*. To appear throughout 1959, the ads should help news writers and editors present to the public a better picture of the engineer and what he does. They will also help to clear up existing confusion between scientists and engineers—terms frequently used interchangeably.

walk-in chamber

A steel company is building an airtight plant in which workers will be required to wear space suits. Intended for high-temperature fabrication of metals like molybdenum, tungsten and columbium, which cannot be satisfactorily processed at such temperatures in ordinary atmosphere, the plant will be filled with pure argon gas.

The plant will be made of 3/16-in.-thick steel plates welded together to form the roof, floor and walls. Air locks, similar to those described in an article in this issue, will permit entry and exit for workers.

As that Sunday night TV personality would put it, "a reeaaly big" inert chamber.

to fill a gap

A supplementary text — on strength of arc-welding joints— has been published by the Arc Welding Section of the National Electrical Manufacturers Association. It is designed for use in elementary college courses on *Strength of Materials*.

Text books in general use in most engineering courses introduce the student to the principles of riveted and bolted design, but rarely devote comparable space to welded design and construction. It is hoped that those concerned with teaching such engineering courses will use the booklet in conjunction with their text. Single copies are available free to educators concerned with such courses; a charge of 25 cents is made to students. Copies from: American Welding Society, 33 W. 39th St., New York 18, N. Y.

(*Footnote*: WELDING ENGINEER long has editorialized on the need for such material . . . often has decried lack of emphasis on welding in engineering courses.)

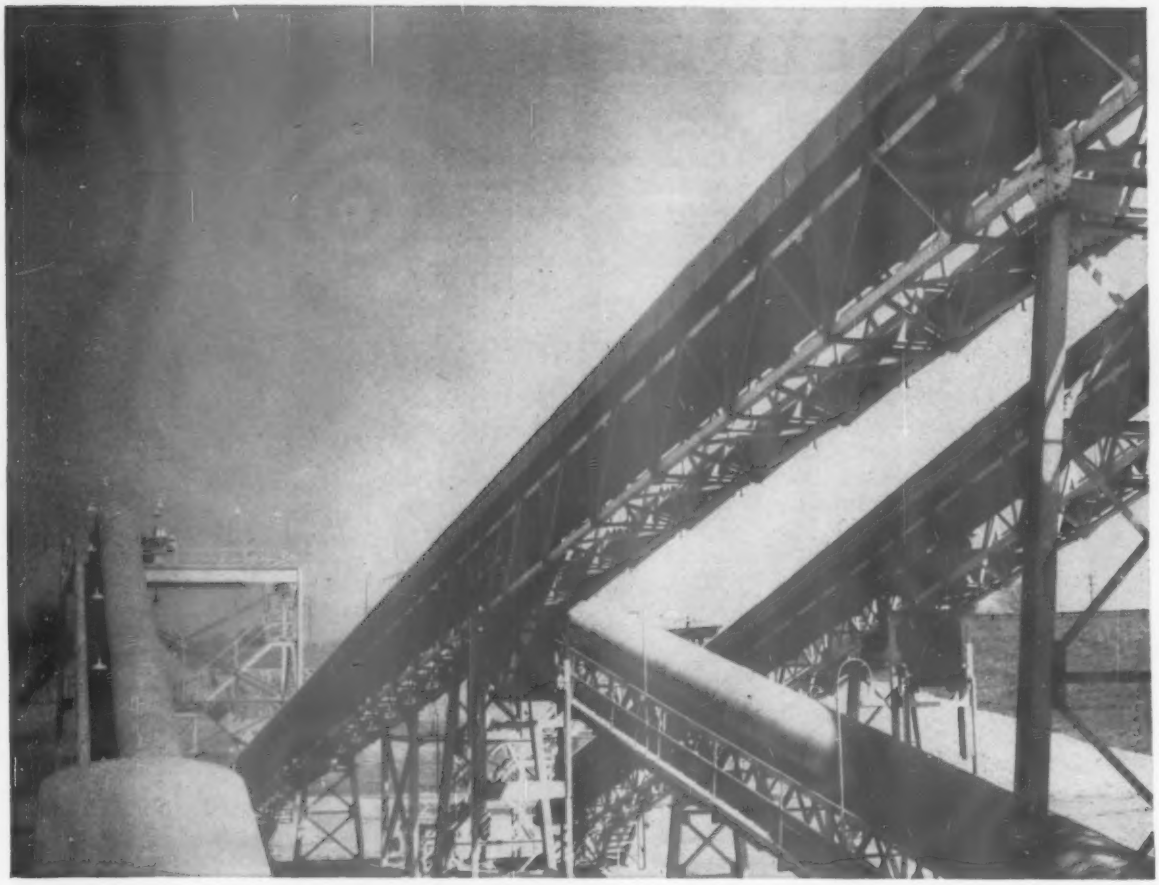
not all propaganda

The USSR exhibition at the Coliseum in New York City (scheduled to close this month after a 40-day run) includes some interesting exhibits, many of which could properly be deemed propaganda . . . if we use that word in the popular connotation: larded with exaggeration.

But one aspect of the industrial exhibit was not propaganda by any means, because some of the machinery on display at the Russian trade fair included welding equipment that is now being imported into the United States. We mean, of course, the electroslag welder, being built by several other European countries under license by Russia.

In addition to the slag welder, the principles of which were again described in *WE's* July *Welding Clinic*, p. 40, the Russians, exhibited a magnet-actuated walking welder, which also utilizes the electroslag process.

For more news about the Soviets, see the article starting on page 40 of this issue. Translated from the Russian by the British Welding Research Association, it describes the important role welding is playing in the present Red seven-year plan.



New—from the ground up, Monarch Cement's new Humboldt, Kansas, plant is one of the most modern cement processing plants in the world.

Now we SCHEDULE

"We do our rebuilding when we want to—not when the machine breaks down!

"Both primary and secondary hammermills are repaired and hardsurfaced at the same time at Monarch Cement Company. We do not stop for one repair now and the other later," says Mr. R. M. Vincent, Maintenance Engineer.

"At last we have found a hardsurfacing electrode which gives *predictable* wear. We can plan our hammer service life so both primary and secondary mills are due to be changed at about the same time. No more unscheduled work

Hammermill hammers are built-up with Lincoln "Faceweld 12" for longer life.

Hammermill repairs!

stoppages because of worn out hammers."

This ability to match the service-life of mill hammers gives great savings in the continuous processing of shale at Monarch Cement Company's new plant at Humboldt, Kansas.

The electrode which makes it possible is Lincoln's "Faceweld 12". Try it on your hammers! Look for your Lincoln District Sales Office or Authorized Dealer in the Yellow Pages.

Before and after photo shows amount of rebuilding necessary on worn hammer.

THE LINCOLN ELECTRIC COMPANY • Dept. 1759, Cleveland 17, Ohio

The World's Largest Manufacturer of Arc Welding Equipment

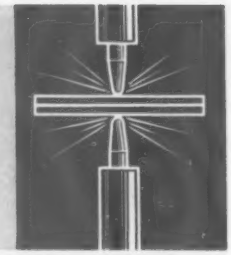
LINCOLN

P.R. MALLORY & CO. Inc.

MALLORY MEMOS

NEWS AND TIPS ON RESISTANCE WELDING

P. R. Mallory & Co. Inc., Indianapolis 6, Indiana

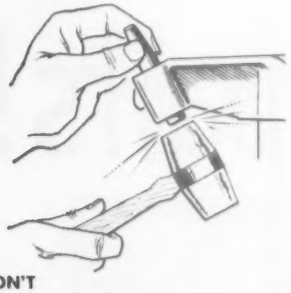


WELDING HINTS

Do's and Don'ts of Resistance Welding

DO

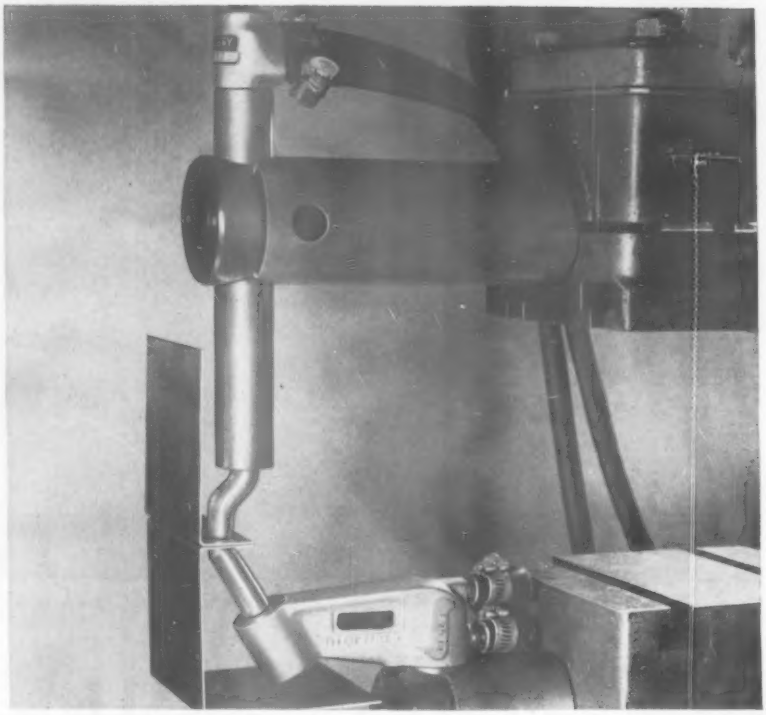
Use the most suitable tip diameter for the thickness of stock being welded. Too small a tip may cause excessive indentation, and too large a tip won't give enough concentration of heat. There is a Mallory electrode to suit every welding need.



DON'T

Don't allow the electrodes to remain idle in tapered holder seats for extended periods. They may bind and become difficult to remove.

Send for this useful chart of 34 Do's and Don'ts for Resistance Welding. Hang it on the wall in your shop for handy reference.



Have Unusual Welding Set-Ups?

Use Mallory *standard* bent electrodes

Welding in tight corners or inside joints and other difficult places can be handled by standard Mallory bent electrodes. You can forget about custom-designs and extra costs for tricky set-ups. The Mallory standard line contains 51 different special shaped electrodes —single bend, double bend and offset. What's more, many Mallory electrodes contain cooling water tubes that are bent in place*...and cool right up to the electrode tip.

Your Mallory distributor stocks a wide variety of special electrodes plus 113 different straight electrodes with various tip designs. There is a Mallory developed alloy to fit every combination of metals and welding conditions.

Mallory welding products are available from authorized distributors located in all principal cities.

*Patent No. 2,489,993

AUGUST, 1959

Welding Engineer

ESTABLISHED 1916

Stupid—like a fox

A PREVAILING NOTION is that Russians are stupid. And they are—*so stupid that they know what they want and will let nothing or no one sidetrack them from their determined goal.*

This is their basis for industrial progress, and every Russian-proposed program indicates welding will play an important role in this progress.

Through the years the Russians have made notable developments in the welding industry, from their patenting in 1885 of carbon-arc welding to their more recent introduction, electro-slag welding.

But they not only developed these methods; they have put them to extensive use as well. Of course, it is possible that the lack of materials in the USSR has made them conscious of welding's advantages in conserving natural resources.

Be that as it may, Russian engineers seem more aware of welding's importance than our own engineers.

Elsewhere in this issue is a brief report outlining the Reds' plan for the welding industry in their current seven-year plan. American industry might do well to consider some of its features.

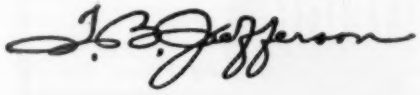
One that surely should be exploited by everyone with an interest in welding reads:

"It should, however, be recognized that modern welding techniques have been adopted on too small a scale in a number of branches of industry, and this backwardness must be put right in the coming seven years."

Many of our designers, engineers and architects should pay heed to this statement—for they, too, are guilty of this "backwardness."

Fortunately, some headway is being made. One major Eastern railroad is putting the finishing touches on the first welded bridge in its system, indicating some design engineers have been led from the woods. But there still is a tremendous amount of inertia to overcome.

Bringing designers, engineers and architects to recognize the value of welding will call for hard work. But it will be well worth the effort. Let's hope it doesn't take seven years to do it.



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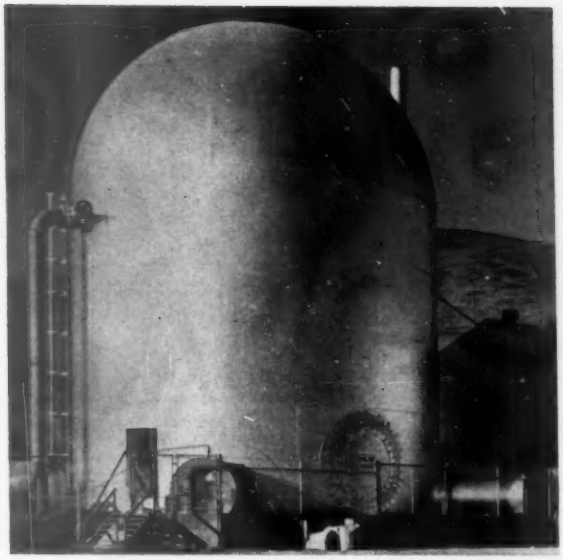
RODS FOR MANUAL APPLICATION

This Hardfacing Rod	For These Conditions	This Equipment or use	How Applied
VICTORTUBE (Tungsten Carbide)	Severest abrasion	Earth cutting, scraping, drilling tools, rippers, augers, ditchers, excavators, loaders	Gas AC-DC Arc
VICTORTUBE (TC) Bare 30-Down	Severest abrasion; moderate impact	Agricultural and earthworking tools. Suitable for acetylene application	Gas only
VICTORTUBE "SPECIAL" (Tungsten Carbide)	Severe abrasion with impact	Oil field tools - rock bits, drag bits, reamers; water well drilling tools	Gas only
VICTOR TUNGSMOOTH (Tungsten Carbide)	Maximum abrasion	Edged cutting tools - bits, blades, farm tools. Smooth, thin deposits on augers, screw flights, paddles.	Gas AC-DC Arc
VICTORITE	High abrasion; sliding friction	Earthmoving and agricultural tools, brick augers, conveyors, mill guides	Gas AC-DC Arc
TUBE VICTORITE	Abrasion and impact	Farm tools, crushers, grinders, mixers, scrapers, fan and screw conveyors	Gas AC-DC Arc
VICTORITE 1	Heat; abrasion, corrosion	Chemical & food machinery, cement pumps, brick dies, dry bearings & journals, expellers	Gas AC-DC Arc
VICTORITE 8	Heat; impact; corrosion; abrasion	Hot dies, stripper bits, exhaust valves & seats, dry bearings & journals, edging rolls, cams	Gas AC-DC Arc
VICTORITE 12	Heat; corrosion; abrasion; impact	Saw-blade inserts, shaft bearings, hot punches, flapper valves, needle valves	Gas AC-DC Arc
VICTORITE CARBON ARC	High abrasion; sliding friction	Farm tools, earth abrasion. Applied by gas. Deposits are exceptionally smooth.	Carbon Arc Gas
VICTORITE Plow Point Bar	High abrasion; sliding friction	Cast-to-shape, weld-on cutting edge for plow shares, digger teeth, pilot bits	Gas
VICTORALLOY	Severe impact; abrasion	Crusher & dredge parts, tamper feet, bucket teeth. A tough low-cost hardfacing.	Gas AC-DC Arc
VICTORALLOY #1	High abrasion; medium impact	Crushers, bucket lips & teeth, muller tires, dozer blades, dredge pumps	Gas AC-DC Arc
VICTORALLOY "A"	Angular shock; extreme impact	Clutch parts, gears, latches, pins & keepers; build-up for hardfacing	AC-DC Arc only
VICTORALLOY "B"	Heavy impact; moderate abrasion	Tractor idlers, sprockets, rolls, crusher parts, pump casings, impellers, liners	AC-DC Arc only
VICTORALLOY "C"	High abrasion; moderate impact	Cement screws, gudgeons, drag chains, pressure rolls, mixer blades & paddles	AC-DC Arc only
VICTOR MULTI-PASS (for Build-Up)	Severe impact; compression	Drill tools, crawler pads, crushers, mine rails; build-up for hardfacing	AC-DC Arc only
VICTOR Ni-Mn (for Build-Up)	Severe impact; compression	Hardmetal underbase for manganese steel parts on crushers, dredges, dippers	AC-DC Arc only
VICTOR Ni-Mn (for Attachment)	Severe impact	A low-cost "stainless" joining rod for crushers, dippers, crawlers, dredges	AC-DC Arc only

WIRES FOR AUTOMATIC & SEMI-AUTOMATIC APPLICATION

This Wire	For These Conditions	This equipment or use
VA O	Severe abrasion; moderate impact	Crushers of all types, tool joints, mullers
VA 1X	Abrasion & compression with impact	Scrapers, bucket teeth, crushers
VA 2X	Severe compression & impact with abrasion	Steel mill rolls, dredge rolls, cable sheaves
VA 3	Severe abrasion & compression with impact	Mill guides, crushers, grinders
VA 4X	Severe impact & compression	Build-up on trunnions, tractor idlers & tracks
VA 5X	Severe metal-to-metal impact & abrasion	Shovel rollers, tractor rollers & idlers
VA 6X	Severe impact, high temp., dry bearing	Steel mill rolls, clutches, roll necks
VA 7X	Severe impact & compression with abrasion	Build-up on mine car wheels & tractor rollers
VA 8X	Earthworking abrasion & impact	Dozer blades, scraper blades, tool joints
VA 10	Extremely severe abrasion; moderate impact	Tool joints, crushers, scrapers, swing hammers
VT 60 (Tungsten Carbide)	Maximum abrasion; earth cutting, scraping	Tool joints, scraper blades, augers
Ni-Mn (Hadfield)	Wear, all types manganese steels	Build-up manganese steel parts for overlay or to size



CONTAINMENT vessel for General Electric reactor at Pleasanton, Calif., has tubular-shaped air locks for personnel entry and exit.

COMPRESSION-seal air lock for the GE reactor has doors which close against a seal (dark border) in the door frame. Pratt engineer Vincent Bicicchi shows comparative size of the unit.

Welding provides— the key for the door to America's nuclear reactors

A NEW LANDMARK is making an appearance on the rural American scene today. It's the containment vessel for nuclear reactors—a dome-like structure of welded steel that may soon become as familiar as the silo.

This vessel, as its name implies, is designed to "contain" a nuclear explosion and prevent atmospheric contamination. The ability to do so derives from the vessel's volume, which is so chosen that it will permit only a very small increase in internal pressure during an explosion.

Naturally, any vessel's strength is only as great as what might be considered its weakest points—the access areas to the interior. But in the case of reactor containment structures, these "doors" are specially designed and constructed air locks.

A major supplier of air locks for the nuclear power industry is Henry Pratt Co. of Chicago. The firm applies manual and automatic metal-arc welding throughout each unit, providing a margin of strength vital to the integrity of the containment vessels into which they are fitted.

Basically, an air lock is a cylinder with a door at each end. Being interlocked, only one door may be opened at a time. Thus personnel or equipment passing in or out of the containment vessel must be temporarily confined in the lock while one door is closed and the other opened. Actually, therefore, there is no direct opening into any nuclear reactor containment vessel.

Fabrication time for Pratt air locks varies in relation to unit size: locks designed for personnel may have openings as small as 3 by 6 ft; others may be large enough to permit passage of trucks.

The 16-ft-long, 10-ft-diameter air lock pictured and described in this article required approximately six weeks work—from the time steel was flame-cut to shape, until the completed unit was stress relieved.

The air lock shell is fabricated from ASTM A201 54-T (firebox quality) steel. Three courses are used, each formed from two half-circles. One course is 4 ft, 2½ in. wide; the other two are each 5 ft, 11 in. wide.

All shell plate is ⅜-in. thick, with a 30-deg flame-cut bevel on the edges. The courses are manually welded with E7016 electrodes. Welds are continuous and back-chipping is used.

Each of the six longitudinal seams, as well as the two circumferential seams, is welded in five passes: the first with 5/32-in. 7016's; the second, third and fourth with 3/16-in. electrodes and the fifth with a ¼-in. electrode.

Power sources for welding are d-c motor-generator sets. The company's Chicago shop, where the air locks are fabricated, has 23 such sets, rated at 300 or 400 amp. The largest welder in the shop is a 1,200-amp automatic submerged-arc unit.

Main components for the bulkheads at each end of the air lock are eight semi-circles flame-cut from ½-in.-thick A201 steel. Door shapes are also flame-cut into these semi-circles. Components are beveled and welded with E7016 electrodes to form four full circles—two each for both ends of the air lock.

Automatic and manual methods are utilized for flame-cutting. Two cutting tables, one with four torches and the other with three, are located in the shop. Both use templates to guide the torches. Oxy-natural gas is used for automatic and manual flame-cutting.

When the interior bulkhead plate has been welded in place (again using E7016 electrodes, although no bevel is used in this application), stiffeners are welded to it. Each of the 15 stiffeners is A201 steel, ¾-in. thick and 7-in. wide.

To minimize distortion, a skip-welding procedure is used in fillet-welding the stiffeners to the interior bulkhead wall. The amount of metal deposited by one electrode is the criterion used here. That is, one electrode is consumed on one side, then another on the stiffener's opposite side beginning where the first ended, etc. The open areas are welded when skip-welding is complete.

Stiffeners are welded on 1 ft 7⅜ in. centers on one side (four of them) and on 1 ft, 5¾ in. centers on the other (five of them). Reason for this unbalance is the need to put hinges on the side with the least stiffeners.

The second or exterior bulkhead is then placed over the other. This second plate has slots corresponding to the stiffener positions. Using the skip-welding technique again, fillet welds are made in each of the slots, thus joining the other bulkhead plate to the stiffeners.

All slot holes (¾-in. wide and 4-in. long on each side of the door; 2 or 2½-in. long above and below) are then filled with weld metal.

The door frame is roll-formed (as were the shell components) in halves, then welded top and bottom with E7016's. The finished frame is 4 ft, 4⅝-in. wide; 8 ft, 2⅛-in. high; and 11½-in. deep.

WELDOR at work on door frame of compression-seal air lock for the Enrico Fermi Atomic Power plant, Lagoona Beach, Mich. Lock has been rotated in fixture to permit easy access. (Long door-dimension is vertical in finished installation.)

The frame's interior surface is lined with a ¼ in. sheet of 304 stainless steel, also 11½-in. deep. The all-around fillet welds joining the liner to the frame are made with 5/32 and 3/16-in. 304 electrodes.

Flooring for the air lock is a "safety tread" steel type resting on four 4-in. I-beams laid transversely on 2 ft, 11 in. centers. Floor-to-frame joints are supported by 2½x2½x⅜ in. angles, one at each end of the air lock. (Another air lock in the making has longitudinal plate framing for the floor.)

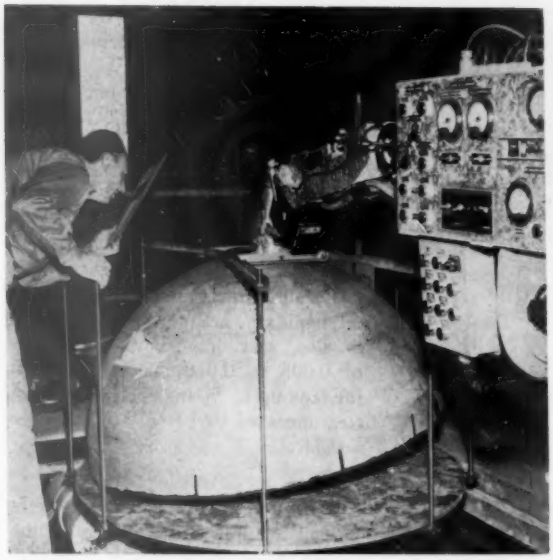
When all welding has been completed, the air lock is 100% inspected—largely by a 170 kvp X-ray unit. Where X-ray is not feasible, a dye-penetrant inspection is conducted. The unit is also stress relieved after bulkheads and I-beams have been welded.

The covering doors to the air lock are also stress relieved. Like the bulkheads, they are fabricated from ½-in. plate and have stiffeners between its inner and outer plates. The stiffeners, however, vary in thickness from ½ to ¾ in. in this case.

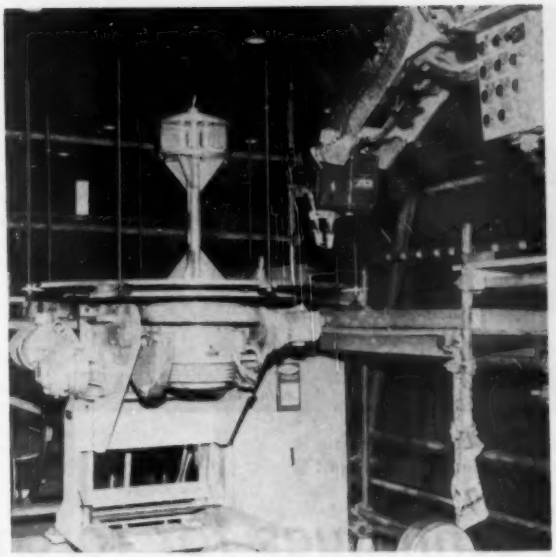
When completed, the doors are 3 ft, 9⅛-in. wide and 5⅞-in. thick. A hole 6 13/16 in. in diameter is flame-cut in the door plates for a heavy-glass peephole.

WELDING the seam between two courses of the Plutonium Recycle Program reactor at Hanford, Wash. All course seams are welded in five passes with E7016's. Man at right is hot peening the weld to minimize distortion.

BULKHEAD and bracing structure for the Hanford reactor are skip-welded to minimize distortion. A second, exterior bulkhead is then placed over the other and welded to the stiffeners through previously cut slots.



ABOVE, weldor watches as arc is struck by Tig welding head. Table of positioner will rotate work at predetermined speed during welding operation. At right in picture is electrical control center.



THIS picture shows ram, welding head and knee action manipulator assembly facing positioner. Welding head may be positioned for welding sphere from either outside, or inside through ports.

Welding positioners aid manufacturer in precision production of jet aircraft

ROCKETS, MISSILES AND JET AIRCRAFT are designed with particular care and accuracy by our nation's engineers. To fulfill the specifications developed by these engineers, it is necessary for manufacturers to have equipment developed just as carefully as the aircraft details.

Lockheed Aircraft Corp., Burbank, Calif., has equipped itself with, among other precision instruments, welding manipulators and positioners developed by Airline Welding & Engineering, Hawthorne, Calif.

By using such precision equipment, Lockheed is able to create aircraft in their final form which are as exact in detail as the engineers' blueprints.

One unit Lockheed recently acquired can automatically position, and weld through ports with an accuracy of ± 0.010 in., the inside of a 54-in. diameter sphere.

To weld the sphere from the inside, the base hemisphere is placed on the headstock, the top hemisphere clamped in place with chill shunt tooling and adjusted with the tailstock.

The ram moves into the sphere through the port, a knee action manipulator moves toward the junction of the hemispheres and the welding head positions itself.

Starting the gas flow, striking the arc and activating the filler wire feed, follow. When the weld puddle forms, the positioner makes a complete revolution plus 1 deg to provide a slight overlap.

This automated weld station consists of a machined tubular base and ways, 2,500-lb capacity weld positioner, ram manipulator and adjustable tailstock, turning roll assembly, knee action manipulator, Tig welding head and a 500-amp balanced wave welder. It is electrically operated and adjusted from a central control panel.

A chill shunt form of tooling is the heart of the Airline positioners. With longitudinal positioners this consists of a mandrel and precision devices to hold the work.

Mandrels are designed to facilitate positioning of various shapes and are rotatable and interchangeable. Each mandrel is fitted with one or more back-up bars grooved to control weld root bead, size and contour.

If steel, stainless steel, titanium, tantalum, molybdenum, zirconium or beryllium-copper is to be welded, a mandrel of highly conductive copper is used. A steel mandrel is used when welding non-ferrous metals such as aluminum, magnesium or special alloys.

Hold down devices consist of a set of adjustable, level-seeking, metal fingers aligned above and on each side of the back-up bars.

Each bank of fingers is activated by a pneumatic foot control. Standard pressure is adjustable from 0 to 300 lb per lineal inch, depending upon the thickness of the metal being worked. Pressure can be increased to 1,800 lb by adding electro-hydraulic boosters.

Each edge of the work is separately positioned, the fingers simultaneously pressing the workpiece edge onto the mandrel and to the center of the back-up groove.

Welding head and carriage travel are controlled by a side-beam track 12-in. deep with 1-in. thick trackways top and bottom. Arc length accuracy of 0.006 in. and lateral accuracy of 0.003 in. are maintained with loads up to 400 lb and carriage speeds up to 300 ipm.

USING an oxyacetylene torch and filler wire, the operator brazes aluminum parts.

by **Howard E. Adkins**
and **Robert A. Ridout***

Techniques for torch brazing aluminum

TORCH BRAZING ALUMINUM parts often furnish more advantages than if fusion welded.

Because of its lower working temperature, brazing requires less preheating. Thus, warpage and distortion are reduced; costs, lowered; heat damage, lessened and, in many cases, a faster joining operation results.

Thin-gage material or material up to approximately ⅛-in. thick can be successfully brazed, as well as combinations of thinner and heavier sheet. Structural shapes and assemblies, including mitered joints, can also be joined by this process.

Among the aluminum alloys, some from both the heat-treatable and non-heat-treatable groups are brazeable. (See the accompanying Data Sheet.) Those alloys generally rated best for brazing are: 1100, 3003, 6053, 6061, and 6063. On the other hand, 2011, 2014, 2017, 2024 and 7075, as well as aluminum alloys with high magnesium content, are not ordinarily recommended for brazing.

As in any joining process involving aluminum, cleaning of base metal is essential. The surface to be brazed should first be freed of oil, grease, oxides, paint and any other foreign material, either chemically or mechanically.

One basic chemical cleaning procedure consists of four steps:

1—Dip the joint area in 5% solution of caustic soda at 150-160 F for 10 to 30 seconds.

2—Rinse in running water.

3—Dip in 10% solution of nitric acid at 150-160 F for about 10 to 30 seconds.

4—Rinse in running water.

Although steel wool, emery cloth or a file may provide adequate joint preparation, chemical cleaning is preferred. However, if filler metal fails to flow freely, these mechanical means are helpful, since abrasion breaks up surface oxides, allowing the flux to react more rapidly.

When brazing aluminum, preference should be given to lap, fillet Tee and lock-seam joints, that is, joints which create a line contact between the parts to be joined. This type of joint design is necessary since the flow of filler metal depends greatly on capillary action.

Flanged joints, where the ends of the sheet or parts to be joined are turned up at the edges, are also suitable, as are Tee joints with or without flanges.

Lap joints are highly satisfactory from a strength standpoint. Overlap, however, should be carefully controlled. If it exceeds ¼ to ⅜ in., or is three to four times the thinner section's thickness, flux inclusions are likely to occur.

Plain butt joints are not usually employed if high strength is required. This particular joint design is prone to undercutting and filler metal does not build up along the butt-joint face to provide any reinforcing strength. If a butt joint is used, good fit-up all along the joint is necessary.

Because brazing depends so heavily on capillary action, joint clearance is also very important. Clearances of 0.005 to 0.010 in. are sufficient for laps up to ¼ in. For longer laps, clearances of 0.010 to 0.025 in. are satisfactory.

Joint clearance must be tight enough to allow a drawing in of the molten filler metal. Thus, it is not possible to use press fits, since too tight a fit will hinder filler metal flow. When filler has completely penetrated the joint, a well-formed fillet can be seen at the opposite end.

At times jigs are necessary to keep parts in proper alignment, but these should be designed to make only point contact with the assembly. This will minimize heat loss in the joint area; and for the same reason, jigs should not contact flux or filler material.

To minimize expansion problems, aluminum jigs can be used. In general, materials having a coefficient of expansion similar to aluminum, with melting points above 1,220 F, are preferred.

Bent tabs, spot welds, clamps, screws, vise grips, etc. may often be used as holding devices. However, self-jigging should be used when possible to eliminate building and set-up costs, and heat loss.

Flux is the next consideration. Used to clean the joint area and to carry filler to the joint, it is usually in powder form and mixed with water or alcohol into a thick paste. Glass or earthenware containers are used for mixing since they will not react (steel containers will cause contamination).

Fresh flux should be mixed every four to eight hours. The fresh mixture is necessary for good operation. If made too long before brazing, it will become granular and difficult to apply.

The flux chosen must melt and become active below the brazing or

*Messrs. Adkins and Ridout are welding specialist and manager, respectively, of Kaiser Aluminum and Chemical Sales, Inc., Field Engineering Dept.

Brazability ratings of aluminum alloys

Alloy Wrought	Brazeability Rating	Silicon	Iron	Copper	Manganese	Magnesium	Chromium	Zinc	Titanium	Melting Range Approximate F
1100	1	1.00 Si	Fe	0.20	0.05	---	---	0.10	---	1190-1215
2014	4	0.50-1.20	1.00	3.90-5.00	0.40-1.20	0.20-0.80	0.10	0.25	0.15	950-1180
2024	4	0.50	0.50	3.80-4.90	0.30-0.90	1.20-1.80	0.10	0.25	---	935-1180
3003	1	0.60	0.70	0.20	1.00-1.50	---	---	0.10	---	1190-1210
3004	2	0.30	0.70	0.25	1.00-1.50	0.80-1.30	---	0.25	---	1165-1205
5005	1 to 2	0.40	0.70	0.20	0.20	0.50-1.10	0.10	0.25	---	1170-1205
5050	2	0.40	0.70	0.20	0.10	1.00-1.80	0.10	0.25	---	1160-1205
5052	3	0.45 Si	Fe	0.10	0.10	2.20-2.80	0.15-0.35	0.10	---	1100-1200
5083	3 to 4	0.40	0.40	0.10	0.30-1.00	4.00-4.90	0.05-0.25	0.25	0.15	1065-1180
5086	3 to 4	0.40	0.50	0.10	0.20-0.70	3.50-4.50	0.05-0.25	0.25	0.15	1084-1184
6061	1 to 2	0.40-0.80	0.70	0.15-0.40	0.15	0.80-1.20	0.15-0.35	0.25	0.15	1080-1200
6062	1 to 2	0.40-0.80	0.70	0.15-0.40	0.15	0.80-1.20	0.04-0.14	0.25	0.15	1080-1205
6063	1 to 2	0.20-0.60	0.35	0.10	0.10	0.45-0.90	0.10	0.10	0.10	1140-1205
6951	1	0.20-0.50	0.80	0.15-0.40	0.10	0.40-0.80	---	0.20	---	1140-1210
7075	3 to 4	0.50	0.70	1.20-2.00	0.30	2.10-2.90	0.18-0.40	5.10-6.10	0.20	890-1180
Cast Alloys										
43	1 to 2	4.50-6.00	0.80	0.60	0.60	---	---	0.60	---	1065-1170
355	3 to 4	4.50-5.50	0.40	1.00-1.50	0.20	0.40-0.60	---	0.10	0.20	1015-1150
356	2 to 3	6.50-7.50	0.35	0.20	0.10	0.25-0.40	---	0.10	0.20	1035-1135
100	1	---	---	0.10	Min. Alum.	99.3%	---	---	---	1190-1215
AlMg 35	4	0.10	0.10	0.01	0.10	7.00	---	---	0.10	
319	4	5.50-7.00	1.00	3.00-4.50	0.60	---	---	1.00		960-1120

1. *Normally brazeable.*
2. *Special techniques and procedures required. Trial runs may be needed to establish techniques.*
3. *Brazing difficult.*
4. *Not brazeable because of alloy composition and limitations in commercially available fillers.*

flow temperature of the filler metal, and when torch brazing, it must flow smoothly and spread out ahead of the filler as well. Being highly corrosive in most cases, excess flux should be quickly removed after the brazing operation.

Flux application is done by brushing or dipping, and must be applied carefully to the joint area since the molten filler usually follows it. No more than 30 to 45 minutes should elapse between fluxing and brazing.

Selection of a suitable filler metal is also important. The AWS-ASTM brazing fillers are identified by their principal elements, *e.g.*, BAlSi-1; B is for brazing filler metal; Al signifies aluminum; Si is silicon. The numbers which follow are for a particular chemical analysis.

BAlSi-1, 2 and 3 fillers are general purpose metals used more often for furnace and dip brazing. BAlSi-2 is available only as sheet stock. BAlSi-4 is also a general purpose metal, but is used mostly in torch brazing. (It may also be used with the other brazing methods, and is recommended for its relatively high corrosion resistant properties.)

Generally, filler metal for torch brazing is in wire form, but for special cases, it may be purchased as shims or in specially coated sheets. These sheets are aluminum alloy clad on one or both sides with a relatively low-melting aluminum-base brazing material. A popular type has a 3003 core with one or both sides clad.

Necessary equipment for torch brazing is the same as for any torch welding process. Oxyacetylene flame is most widely used, but oxy-hydrogen will also give satisfactory results. Other gases may be used on thin materials, but are slow and demand longer preheating.

Tip selection is an important part of the operation. If tip orifice is too small, excessive time is used in preheating. If gas pressures are extremely high with a smaller tip, there is too much force against the joints, tending to blow away flux.

A soft reducing or carburizing oxyacetylene flame is most desirable because it protects against oxidation. A reducing flame has a feather extending from the central or inner core and should be two or three times the inner core in length. A neutral flame may be used, but it is difficult to detect oxidation if it occurs. Oxidizing flame should never be used.

Flame temperature is approximately 6,300 F, providing a quickly obtained brazing temperature. Prolonged heating at this temperature, however, is not recommended because of the annealing effect on aluminum. After cleaning and fluxing, brazing should begin as soon as possible.

Torch position should be similar to that used in gas welding. Flame is moved back and forth over the work so the parts reach a uniform preheat. A good technique is to play the flame outside the brazing area and move steadily toward the joint, thicker sections receiving more play.

As preheating continues, flux moisture is driven off and a white, dry flux deposit remains. This gradually melts, flowing over the joint as it becomes more fluid, and indicating brazing temperature has been reached. Flame should be played along joint edges for added assurance.

Filler wire is then touched lightly to the joint, and if correct brazing temperature has been attained, the molten filler will spread smoothly over the joint. If a large, heavy joint is being brazed, it may be necessary to withdraw the wire frequently and reheat the joint to brazing temperature.

Heating and the addition of filler metal continues until well-rounded fillets are formed on both joint sides. In all cases, use enough filler to fill the joints, but avoid excessive use, which will separate parts being brazed and decrease joint strength.

During all stages of preheating and brazing, care must be taken not to overheat the parent metal. Ideally, brazing occurs at 75 to 100 F below the base metal's melting point, but with sufficient care, it may be as close as 20 F.

When the required joint is completely brazed, the assembly should not be moved until the added filler metal solidifies. Cooling after brazing is usually done by uniform quenching in hot water.

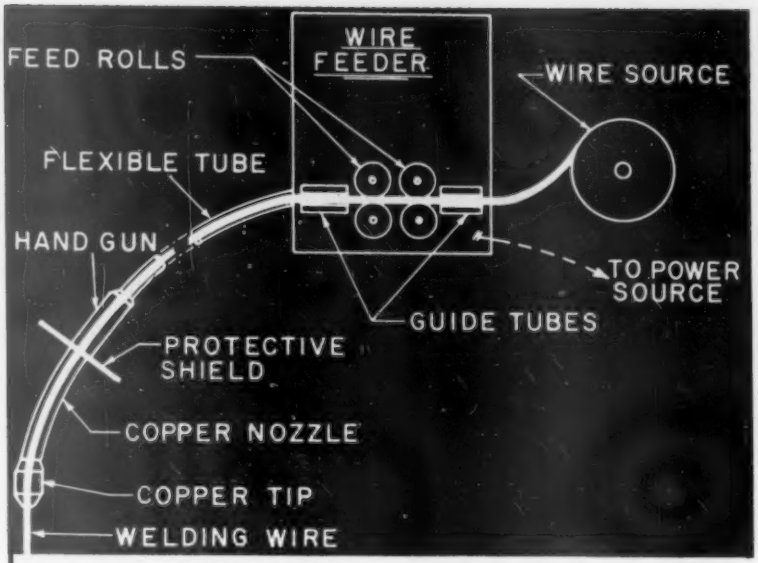
Flux removal after the brazing operation can be accomplished in several ways. Immediate immersion in hot water is one effective and rapid means. An alternative combines hot running water with vigorous fibre brush scrubbing.

Other mechanical means (*e.g.*, grinding, wire brushing) are not recommended since the fine particles broken from the flux crust become embedded in the surface and remain as possible corrosion sources.

A second method of flux removal is an acid bath. Typical cleaning sequences include 20 to 25 minutes immersion at 150 F in a 5% sulfuric acid solution; 5 to 10 minutes immersion at 150 F in a 10% solution of sulfuric acid; a hot water dip followed by a two to five minute dip in a 1½% hydrofluoric acid bath; or a five minute dip in a 10% nitric acid and 0.25% hydrofluoric acid solution.

To prevent contamination of the prebraze cleaner with flux, always use a separate acid bath for postbraze cleaning. Regardless of the chemical cleaning method used, a final rinse in hot water is required to remove all acid. And finally, brazed assemblies should be dried to stop water spotting.

PORTION of fuel system for aircraft is torch brazed using three additional torches for preheating.



How to get the most from semiautomatic welding machines

SEMIAUTOMATIC welding equipment looks trouble-free, and units are being produced to take rugged service without difficulty.

But despite this ruggedness, and simplicity, weldors often fail to obtain maximum performance from their equipment because:

(1) They do not observe basic rules of operation.

(2) They do not appreciate overall effect on deposition rate and efficiency of changes in operating variables (*e.g.*, wire feed rate, welding current, length of exposed wire).

In manual-arc welding, the electrode is frequently viewed as the first source of difficulty when undesirable welds result. The tubular wire used in open-arc welding is seen in the same light.

However, many welding difficulties can actually be related to the ***wire feed unit,*** rather than the wire itself. This does *not* mean care and uniformity are unessential in wire production. But at the same time, satisfactory wire cannot operate successfully in a worn, inefficiently operating wire feed unit.

Commercial feed units are not necessarily compatible with all types and makes of power sources, and minor changes in their internal wiring or an additional adapter may often be necessary.

This problem is most critical when combining a feed unit and a constant-potential power source from different manufacturers. If difficulties in hook-up are encountered, the power-source manufacturer should be consulted for recommendations on necessary modifications.

Condition of feed rolls is an important factor since they must produce adequate pressure to smoothly project wire forward. Loose feed rolls result in wire slippage and nonuniform projection. Excessively tight feed rolls result in distorted, smashed wire which may jam in closer fitting portions of the exit nozzle.

Feed rolls on conventional, commercial units vary widely in design. However, newer units are more foolproof in operation than some earlier feeding mechanisms. Most manufacturers design their feed rolls to be used successfully in older units.

Feed rolls and wire guides must be aligned to prevent excessive wear and possible wire deformation. Alignment can be checked by inserting a short length of wire through the guide tube and feed rolls.

Pressure on feed rolls should be increased to the required level while the wire test length is in place to insure true alignment.

The burr-free wire is fed to the work area through a flexible rubber tube. Condition and position of this tube are also important in successful open-arc welding operations.

The tube should be kept as straight as possible. Any sharp kinks or bends increase passage resistance and cause severe kinking; poor, erratic feeding.

Normal feeding through the rubber tube produces internal scoring. Fine particles of surface material from the wire itself, or from the tube's inside surface, may collect at restricted points, further hampering wire passage. (Thus, it is often necessary to remove the wire and blow the tube out.)

Wire passage can be improved by adding finely-ground lubricants. Powdered graphite may be used; however, it has a tendency to collect and pack at tight points in the tube, producing a degree of conduction

and arcing in the tube itself.

The preferred lubricant is powdered molybdenum-sulphide which provides easy slippage and minimizes any possible internal arcing. (A cored, rubber tube, recently introduced, has a hard-steel spring which surrounds the wire and reduces abrasive wear. These tubes reportedly are more efficient and longer-wearing than older types.)

Inert-gas welding gun nozzles generally are more complicated in design than those of wire feed units designed primarily for surfacing uses; the former is water cooled and wire is fed into the arc in an almost straight line.

On the other hand, the nozzle of surfacing equipment is air-cooled and consists essentially of a bent copper tube. Wire traveling at high speed must make about a 45 deg turn during the few inches of passage through the nozzle. Wear on the internal surface of this curved tube is rapid and internal grooves and small points of impingment develop.

Highly worn nozzles can ruin the performance of any automatic wire. Internal grooves may cause premature arcing within the nozzle, and although the small welds resulting are broken immediately by forward motion, an erratic arc and unacceptable weld deposits are produced.

(New designs are being introduced to decrease the frequency and magnitude of problems caused by worn nozzles. One of the most promising designs uses a hard-steel spring in much the same manner as the cored-rubber tube mentioned above.)

Wire emerges from the nozzle through a small copper tip whose orifice is approximately 1/32 in. in diameter larger than the wire.

This copper tip is the most exposed portion of the unit and hence, most likely to be damaged during welding *(e.g.,* spatter collects and must be removed periodically to avoid constricting wire flow).

Only after overall wire feed performance has been checked out can attention be given to the wire itself.

Many operating difficulties stem from poor practice in loading wire on the payout reel. The following step-by-step procedure should help eliminate such difficulties:

(1) Without cutting tie wires or bands supporting the coil, unwind sufficient wire to run through wire guide and feed rolls.

(2) Mount coil on payout reel and clamp firmly in place.

(3) File wire end smooth.

(4) Insert through feed rolls and adjust feed roll pressure.

(5) Cut restraining wires or bands on wire coil.

(6) Feed the wire through the flexible tube.

(7) Adjust tension on wheel-brake so reel will not revolve freely, but also avoid excessive drag.

In normal manual-arc welding applications, welding current is the primary concern. Amperage is adjusted up or down to meet requirements of a specific application or particular weldor. Voltage is shifted only within narrow limits, and for the most part electrode coating composition and formulation determine general operating voltages.

In open-arc welding, however, the problem becomes more complicated. Voltage, amperage and wire feed speed must be controlled within normal operating limits. Failure to control or integrate any one of these three major characteristics results in poor performance and undesirable welds.

With constant-potential power sources or constant-voltage wire feed units, arc length or arc voltage is set at the desired level. Voltage, thereafter, is maintained essentially uniform throughout the welding operation. With a motor-generator power source or a constant-feed unit, voltage varies with arc length. And arc length variations can result in sharp changes in operating characteristics of welding wire and in the appearance of weld deposits.

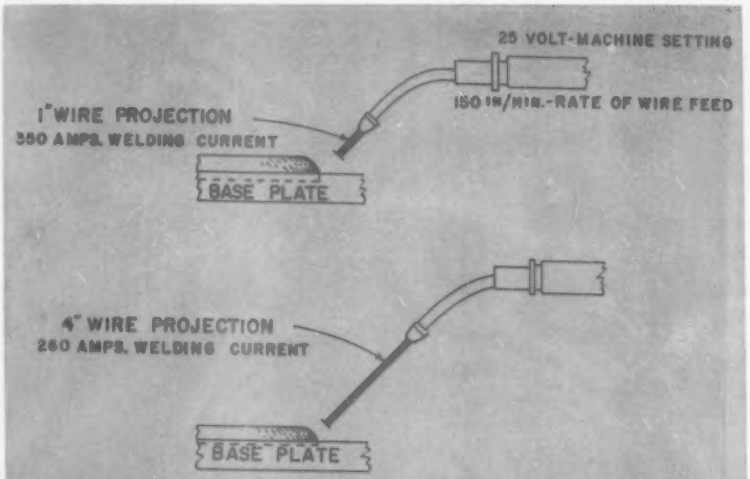


FIG. 1—Typical effect of wire extension on welding current.

Wire feed speed may or may not be an independent variable. In the case of constant-speed wire feed units, rate of wire travel is set in terms of inches per minute, and is not altered by changes in other variables. If a constant-voltage wire feeder is used, however, rate of wire speed will vary as required to maintain the desired arc voltage.

General welding characteristics of open-arc welding wire may be altered drastically by a change in wire length extending beyond the nozzle. Increasing the extension from 1 to 4 in. will reduce welding current requirements approximately 25%.

This reduction in current must be accompanied by a rebalancing of current and rate of wire feed relationship. Rebalancing is automatic with a constant-voltage power source. For other power sources, rate of wire feed must be increased, or welding current decreased, to compensate for changes produced by the increased wire projection.

In many cases, this decrease in welding current with increased wire projection can be used to advantage; for example, overlaying with a 1-in. wire projection at 200 ipm using a 400 amp welding current.

This same rate of deposition could be maintained with a current of only 300 amp if wire projection were increased to 4 in. The lower welding current and heat input result in decreased base metal penetration

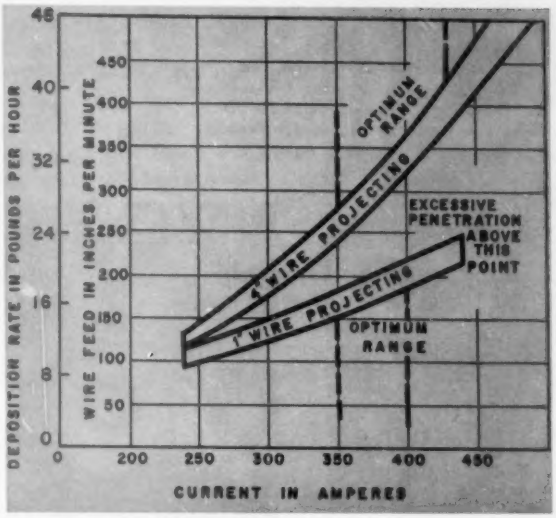


FIG. 2—Wire projection and welding current.

and reduced weldment warpage.

Manipulation required to maintain minimum arc-length or arc-voltage varies with the power source, *e.g.*, when using a constant-potential power source, length of exposed wire must be decreased to off-set an excessive rate of wire feed.

If feed rate is inadequate to maintain the short arc, performance can be improved by lengthening the wire projection. When an m-g or d-c rectifier source is used, technique must be reversed to establish and maintain desired arc length.

The effect of wire projection on deposition rates and over-all performance can be seen in figure 2. With a 1-in. projection at 375 amp and a feed rate of 175 ipm, McKay Tube-Alloy wire will deposit about 17 lb of weld metal per hour.

At the same current level wire speed must be increased to about 300 ipm to provide good operation with a 4-in. wire projection. Under this latter condition, hourly deposition is better than 30 lb.

Thus, wire projection becomes a very important factor in determining deposition rate at any given current level. A higher rate could be obtained at the same welding current, 375 amp, by further extending the wire projection to 6 in.

Semiautomatic welding wires produced by various manufacturers have optimum operating conditions, just as the manual coated electrodes do. Sensitivity of wire to changes in operating conditions varies from brand to brand, as well as within the several grades of wire produced by a single manufacturer.

Excessive changes in voltage will result in extremely heavy porosity. Excessive welding current frequently causes a breakdown of the welding operation, in the same manner as a manual electrode used with currents above its operating range.

As mentioned above, deposition rate is a function of the inter-relationship of welding current, wire projection and speed. Figure 3 shows typical settings for a wide range of combinations of these variables.

This emperical table provides information on optimum welding conditions for 3/32-in. wire in a current range of 250-500 amp, and a feed rate of 150-450 ipm. Deposition rate of these wires, expressed in pounds of weld metal per hour, is equal to approximately 10% of the wire feed rate measured in inches per minute.

(Data in figure 3 are applicable only to 3/32-in. semiautomatic Tube-Alloy open-arc wires produced by The McKay Co., Pittsburgh. Similar tables can be developed for wires of other sizes and manufacture.)

Emperical tables enable the user to quickly determine approximately the best operating range if two variables are known. For example, using a 1-in. wire projection at 400 amp, a wire feed speed of 210 ipm would be necessary to deposit weld metal at a rate of about 21 lb per hour.

If welding current remained at 400 amp and wire projection was increased to 4 in., then approximately 335 ipm of welding wire would be required for the most economical operation possible.

Data obtained from this or similar graphs, however, can be used only as guides. Further minor adjustments in wire projection often are necessary to establish ideal conditions for a specific application.

The following simplified rules point the way to maximum control of operating variables with open-arc, semiautomatic welding equipment:

1—Set desired wire feed.

2—Set the corresponding welding current.

3—Weld with an arc length that provides minimum arc voltage.

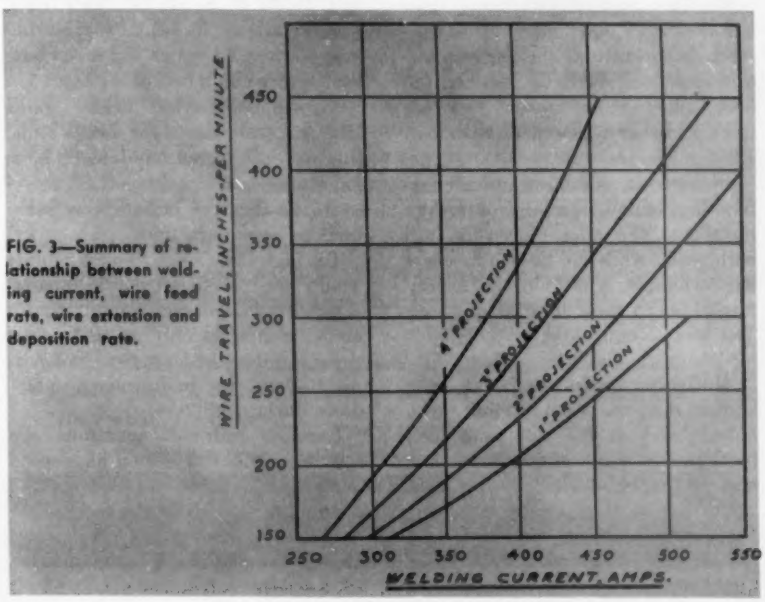


FIG. 3—Summary of relationship between welding current, wire feed rate, wire extension and deposition rate.

GERMAN welder supervises a thermit welder joining track lengths. Wooden ties seen in left photo are becoming outmoded in Germany and are being replaced by concrete ties, as shown in photo at right.

A report from Europe

Welded rail, concrete ties win German approval

by **Harry J. Miller**

TAKING A LEAD from the United States, Germany is expanding its use of continuous welded-rail for increased passenger comfort and reduced maintenance costs.

And again like the U. S., they have found that continuous welded-rail also presents problems.

German Federal Railways now has nearly 7,000 miles of welded track in operation, the longest section stretching 10 miles between Lubeck and Grossenbrode. And old track is being replaced at a rate of 1,200 miles per year.

In contrast, other European countries lag behind. France is currently installing 500 miles of welded rail each year, while in England, where the technique is still in the experimental stage, their first 50 mile section was recently laid.

Railway engineers have long known that the weakest link in a bolted track is the rail joint, and in Germany many efforts have been made to increase the joint strength.

Various methods were employed (*e.g.*, roller-mill hardening with compressed air; mist spraying; induction hardening, on-the-track hardening with oxyacetylene torches), but German engineers were able to increase joint strengths only 15% for the first service period. Although encouraging, this increase did not eliminate maintenance; it only reduced it.

(However, the Germans have held present-day joint maintenance costs to 10% of their total maintenance bill. In the U. S., on the other hand, the American Railway Engineering Association estimates joint maintenance to be as much as 45%.)

To appreciate the welded rail's life-span, consider these facts. Rails, however fabricated or joined, have an average service life of 40 to 50 years, as they are moved from main lines to secondary lines.

During this span, bolted joints would need 11 to 15 major repairs. Welded rails, however, would require major overhauls only seven to nine times, totaling at least two, and possibly seven, less maintenance operations during rail life.

German railroad operators are convinced that rail life on high-speed main lines can be extended by discontinuing bolted joints and substituting long, welded rails, which remain fixed and stable even after an extended period of use.

Fritz Birmann of German Federal Railways states: "All the great strides in the development of continuous track have been connected with permanent-way welding techniques. We have found it necessary to make further improvements and to perfect welding. For example, we find it advisable for rails to be fabricated in 393-ft lengths in the welding shops. A flash-butt welder, which is largely automatic, can turn out as many as five welds an hour, producing joints of great fatigue strength.

"Our most commonly used process for on-site welding is the thermit method, and this has been much improved in its method of working and in the simplification of equipment."

Thermit rail welding replaces previously used weld plates and the heavy, cumbersome clamping gear they required. In addition, wear resistance of thermit welds has been improved, helping to avoid weld depressions which appear after considerable service.

"There is as yet no practical process by which wear resistance of welds can be accurately and reliably determined by testing machines. Extensive operation tests were therefore necessary to obtain the best composi-

tion for the welding mixture," Birmann says.

Present goal of the thermit welding team is to shorten preheat time from its present 25 minutes by injecting oxygen. Tests conducted to date seem to offer promise.

In contrast to the U. S. where extensive use is made of oxyacetylene pressure welding for continuous rails, the Germans seem to feel that this method produces welds not safe enough in service, and that the technique prolongs production time.

(See *Wabash Railroad proves economy of welded rail*, and *Swiss railwelder in production* . . . WELDING ENGINEER, Feb., 1958, p. 32 and Jan., 1959, p. 35, respectively.)

To emphasize the efficiency of the welding processes they use, German engineers point out that only 0.003% of an estimated 4 million flash-butt welds broke in one year. Thermit welding is equally reliable, they say, with a low failure rate of only 0.018% in 1½ million joints on service tracks. These failures were usually external or due to faulty execution, and not the fault of the process itself.

One major problem when using continuous welded rail is the ties. Track laid on wood ties is subject to distortion, and although the Germans have 1,500 miles of continuous rail laid on wood ties, they have 2,700 miles on concrete ties.

This latter type, they claim, helps the rails resist distortion. And by roughing the tie underside, German engineers are able to force them deeper into the ballast, increasing resistance even further. They also feel that these ties are more economical than those made of wood.

Welded track yields two years more service than bolted track before needing repairs, according to the German estimate. In addition, welded joints increase tie life an average of six to ten years, depending on the type of service.

These savings can be appreciated by comparing time consumed for maintaining bolted track to that needed in keeping welded track operational. Bolted track carrying heavy loads daily requires 80 working days of maintenance each year. The same track—welded—would need only 40 days per year.

Welding Fixture and Positioner Manufacturers Specify . . .

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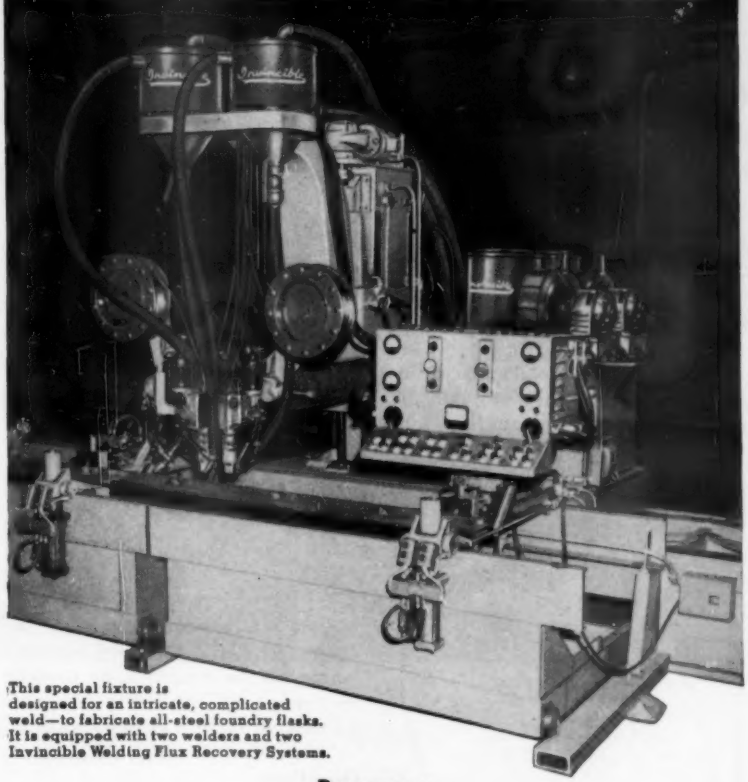

This special fixture is designed for an intricate, complicated weld—to fabricate all-steel foundry flasks. It is equipped with two welders and two Invincible Welding Flux Recovery Systems.

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the welding clinic
Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

How to determine tank gallonage

Question:

Do you have any short formula for figuring out the gallonage in an ellipse or oval tank?

Answer:

To determine the total capacity in gallons of an elliptical tank (Fig. 1) use the following formula:

$$\text{Capacity} = \frac{0.7854\ ab \times L}{7.48}$$

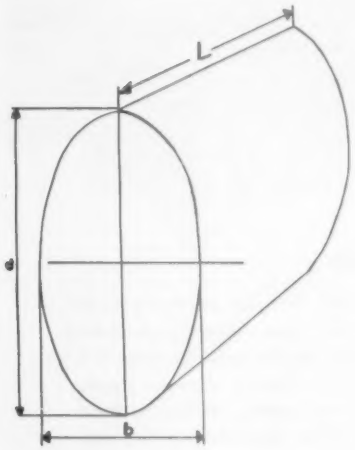

Fig. 1

Some tanks are not true ellipses as they are formed by inserting a square or rectangle between two semi-circles. To figure gallonage in these types of tanks use this formula (See Fig. 2):

$$\text{Capacity} = \frac{0.7854d^2 + de \times L}{7.48}$$

In determining the number of gallons in an elliptical tank in a vertical position, interpret "L" as being the depth of the liquid. If the elliptical tank is in a horizontal position, like home fuel tanks, the only way gallonage can be figured is by calculus involving a different formula for each fraction of an inch change in depth.

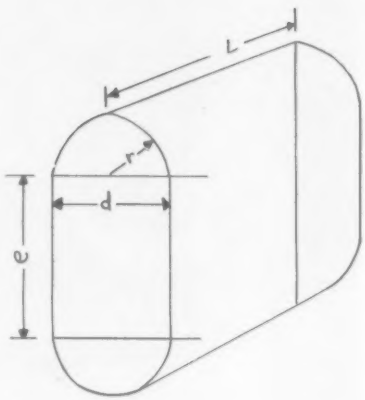

Fig. 2

Question:

We have run into a production problem in which we must join aluminum to glass. We understand the two can be soldered. If this is so, could you give us more information?

Answer:

There is a new technique, accidently discovered by a staff member of Los Alamos Laboratory, that works satisfactorily with glass and ceramic materials when fastening electrical connections, and for similar light work. By using the new method, glass may be soldered to aluminum, according to the Reynolds Metals Co., Richmond, Va.

In this process, the surface of a grinding wheel is loaded with a soft solder. Using the loaded wheel, it is possible to tin a wide range of materials by abrading their surfaces. Then, conventional soldering methods can be used to join materials to themselves or to other materials.

The loaded grinding wheel has made such previously thought "unsolderable" materials as borosilicate glass, titanium, molybdenum, tantalum, stainless steel, tungsten, ceramics and cobalt easily tinned and subsequently soldered by conventional means.

Originally, a medium grit wheel, ¼-in. in diameter, ½-in. long and mounted on a ⅛-in. diameter shaft was used, but other types and sizes of wheels have been successfully experimented with.

It is best to preheat the wheel prior to performing the tinning operation. Then, load the surface with a soft solder such as Wood's metal or 60-40 lead-tin solder. Ordinary grinding pressure can be used to lightly abrade the surface of the material where tinning is needed.

Heat generated by friction melts the solder causing it to run onto the newly roughened surface, forming a close contact, and tinning the work surface. Then, to solder, use a standard 50-50 lead-tin composition, dropping the molten substance on the tinned surface.

The Editors will make every effort to answer all questions submitted to this department. If you have a question concerning welding or related processes—or a tip you would like to pass along to other readers—send it to *The Welding Clinic*.

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A Report from Russia

"Welding figures prominently in 7-year plan"

The following article is a literal translation of the foreword to "Automatic Welding," *a Russian publication recently translated by the British Welding Research Association.* WE *thanks the association for permission to reprint this informative article.* The Editors.

As A RESULT of the triumph of socialism, the Soviet Union has embarked on a period of gradual transition from socialism to communism.

The forthcoming twenty-first congress of the Communist Party of the Soviet Union, which will discuss the plan for our country's development in the next seven years, will go down in history as the congress of the builders of communism.

The principal task of the plan for 1959-1965 is laid down in Comrade N. S. Khrushchev's address to the twelfth congress of the C.P.S.U.: it involves further great increases throughout our economy by the priority development of heavy industry. This will considerably strengthen the economic power of the country ensuring continuous rises in the standard of living.

Steel production under the plan will increase by 1965 to 86-91 million tons, *i.e.*, 56-65% more than in 1958; 65-70 million tons will be rolled, which is 52-64% more than in 1958. The plan also provides for a considerable increase in the output of non-ferrous metals, primarily aluminum (2.8 times the 1958 tonnage). The increase in metal output will be followed by a rising production in different types of welded structure.

Simultaneously with increases in the quantity of welded structures, great changes must take place in welding techniques. The average level of mechanization of welding will rise rapidly to 40% by the end of the seven-year plan; in boilermaking and locomotive production it will be 50%, in the building industry about 60%, in rolling stock manufacture 70%, and in shipbuilding 85%.

The use of automatic and semi-automatic submerged-arc welding, and also resistance welding, is to be multiplied 2.5 times, the use of electro-slag welding is to be doubled and gas-shielded arc welding will be used six times as much. The electro-slag process for improving the quality of ingots and castings by electro-slag feeding must become more widespread; so also must the improvement of the quality of high-alloy steels and alloys by means of electro-slag remelting.

Welding will be developed through the most up-to-date techniques and the wide application in industry of Soviet welding science, but there is still a gap between the level of the latest developments in welding technique and industrial practice.

Soviet welding achievements both in science and in practice have enabled our metal-working industry to outstrip the most highly developed capitalist countries in a number of fields. In Russia we have developed the modern method of electro-slag welding for plate of practically unlimited thickness, bringing about a revolution in heavy engineering. We have developed advanced methods of welding metals in a shielding atmosphere of carbon dioxide gas, and a method of friction welding by a new principle has been proposed.

By the use of timing circuits for resistance welding, Soviet scientists and industrial workers have mechanized the welding of oil and gas pipe lines in a new way. In principle, the mechanization of welding in erection and field conditions has been solved.

The Soviet Union is the first country to use under work conditions the roll method of manufacturing large containers.

Highly efficient methods of multi-arc, multi-electrode, and multi-phase submerged-arc welding and hardfacing have been developed earlier in the USSR than abroad. An advanced method of producing welded thin-walled large-diameter steel tube with straight and spiral welds for high pressure mains has evolved from high-speed multi-arc submerged-arc welding.

We were the first to use advanced methods of welding steel reinforcement for concrete.

Soviet welding engineers have mastered the welding of many new structural steels and alloys, and new metals such as titanium; they have put the study of the weldabilities of metals and alloys on a genuinely scientific basis. Soviet structural engineers have developed new designs for various types of welding equipment and machinery and current sources for arc, electro-slag, and resistance welding (for example, trackless machines and self-propelled heads for submerged-arc welding, the combined transformer and current regulator, electro-slag, etc.).

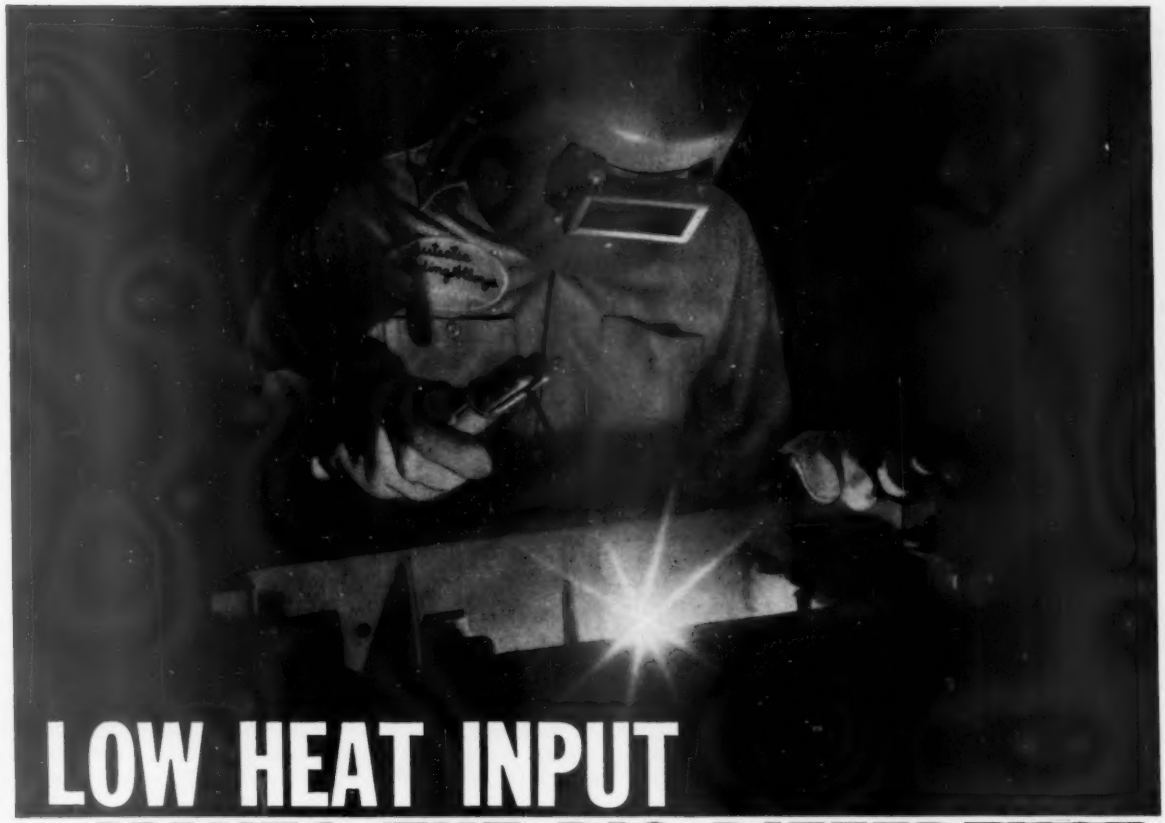
It should, however, be recognized that modern welding techniques have still been adopted on too small a scale in a number of branches of industry, and this backwardness must be put right in the seven years.

The seven-year plan provides for the basic expansion and reconstruction of existing undertakings in manufacturing industry through full mechanization and automation of production involving renewal and modernization of much equipment.

In this connection, serious attention must be paid between 1959 and 1965 to expanding the output of the latest types of welding and jigging equipment, and also of equipment for mechanized welding. We must shift from the mechanization and automation of separate welding operations to the mechanization and automation of processes as a whole, and to continuous and automatic lines equipped with the latest high efficiency welding equipment.

Comrade N. S. Khrushchev's address requires the large-scale adoption of the Paton method for the production of various components by welding. This will considerably reduce unproductive and laborious working in casting, forging and other methods of metal-working.

A large number of blast and open hearth furnaces and new cement works will be built in the next few years. When these plants are built,



LOW HEAT INPUT MAKES THE BIG DIFFERENCE

in cast iron welding

Anyone who has done cast iron welding is familiar with the trouble and costly side effects that are the rule rather than the exception in this application. Brittle welds, stress cracking, a hardened zone at the line of fusion, machine tool damage, and lost time are among the major drawbacks.

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site welding is to be fully mechanized for the first time in the world.

Special tasks face those responsible for welding techniques in connection with the huge expansion planned for the chemical industry, and the new trends in power generation and the fuel industry.

The total output of the chemical industry is to be almost trebled between 1959 and 1965. The production of synthetic materials, nitrate fertilizers and sulphuric acid will increase greatly.

Over 140 large chemical undertakings are to be constructed or completed, and over 130 will be rebuilt. To give these works the latest equipment, the Soviet engineering industry must multiply by nearly 3.5 times its output of chemical plant. Corrosion-resistant steels and alloys are widely used in this branch of engineering as in no other: high-chromium and chromium-nickel steel, and alloys based on aluminum, titanium, niobium, tantalum, and other new metals.

Soviet welding engineers must as soon as possible improve present methods and invent better ones for the welding of chemical plant. In this connection, the following processes must be developed: brazing in a vacuum, welding by electron-beam, welding in hermetically-sealed chambers filled with helium, welding by stored energy, etc. . . .

Without exaggeration, it may be stated that the successful solution of the new and magnificent tasks facing the Soviet electrical power industry depends to a great extent on the reliability and efficiency of the welding of the modern heat-resisting steels in boilers and turbines.

We know that serious difficulties, connected with the proneness of the weld metal to cracking both during welding and under load were encountered with the first 150 MW steam turbines, and in the welding of thick-walled steam tubes and steam superheater tubes made of austenitic steels. Soviet welding engineers must try to overcome these difficulties, and they must collaborate with metallurgists to work out a reliable welding procedure for heat-resisting steels. Attention must first be paid to the production of the so-called precision austenitic electrodes, manufactured from steels and alloys which are spectroscopically free from gases and injurious low-melting impurities. . . .

It is the task of Soviet welding engineers fully to mechanize welding work on new pipelines, and to improve the welding techniques used in the engineering works supplying the oil and gas industries with the latest equipment, also in the works producing large diameter welded tubes for main pipeline, as well as the tanks and other containers used for storing oil and gas.

The great increases in the planned output of steel, aluminum, and other metals, and correspondingly in the scale of metal working, make the present shortage of metal particularly acute. As we know, welding techniques enable much to be done in that direction. We are not referring only to the wide adoption of the hardfacing of worn parts, or to the manufacture of bi-metallic articles with a comparatively thin working layer of alloy with the speci-

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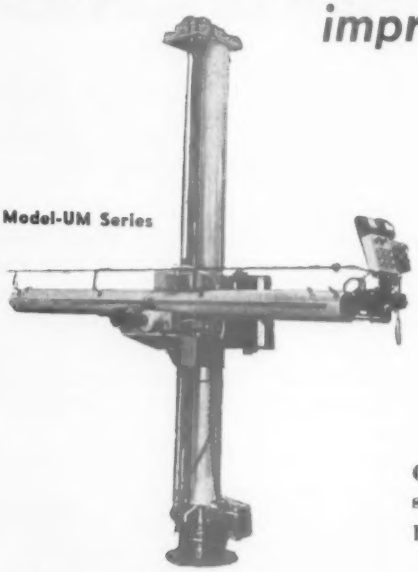

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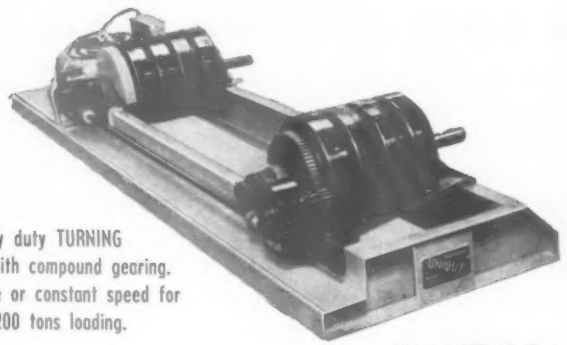

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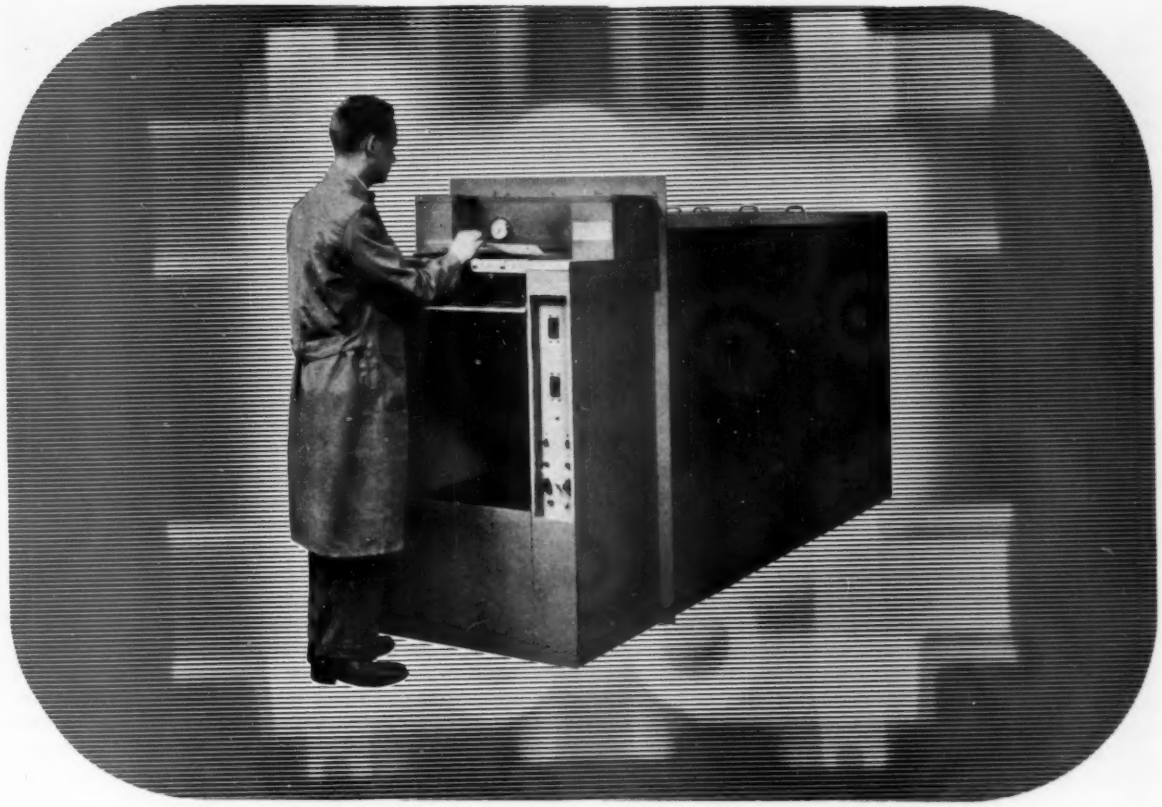

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fied properties. We must develop work in the further rationalization of welded structures, and on the improvement and perfection of the methods by which these structures are designed and built, using metal as economically as possible, and making use of its properties to the full.

The time has come decisively to improve the design of welded structures; for this purpose, serious attention must be paid to improving the qualifications of structural engineers, and also to the training of fresh teams, familiar with welding techniques, and able to design reliable, efficient structures of minimum weight.

In the light of the fresh instructions from the Party and the Government concerning the reorganization of higher school work, it is relevant here to dwell on certain problems of the training of teams of engineers for the welding industry. The measures which have been laid down to make higher school education more practical will undoubtedly help to improve the training of welding engineers. There are however, still a number of specific points which urgently require solution, namely the syllabuses for the training of welding engineers.

At the overwhelming majority of universities in our country, welding engineers are trained at the mechanical faculties, where future specialists are taught about machine parts, theoretical mechanics, the theory of machines, technical draughtsmanship, descriptive geometry, etc. The student not only learns about and designs hoisting plant and machinery, but he is not taught sufficient about the science of metals. On leaving an institute, a graduate receives the title of welding engineer-mechanic, but actually he is more a mechanic than a welding engineer.

Alloy steels and alloys, aluminum, titanium, and other non-ferrous metals, and alloys based on them, are being used more and more widely in modern industry. Even more use will be made of them in the forthcoming seven-year plan. It was pointed out in Comrade N. S. Khrushchev's address that the engineering industry is oriented towards the wide use of materials with improved and special characteristics and properties (corrosion and heat-resisting metals and light alloys).

In such conditions, a welding engineer must have a profound knowledge of metallography and metal physics, including the heat-treatment of metals, the metallurgy of various steels and alloys, physics, chemistry and physical chemistry. However, the necessary attention is not being paid to these subjects at the mechanical faculties. It has now become necessary to pay considerably more attention to the study of the metallurgical process. Only on this condition will our industry receive teams of engineers capable of improving Soviet welding techniques.

The Soviet people, inspired by new and splendid prospects, is setting out to fulfill the seven-year plan—a historic program for the development of communism in the USSR. Soviet weldors in science and industry are determined to make their contribution to communism in our country.

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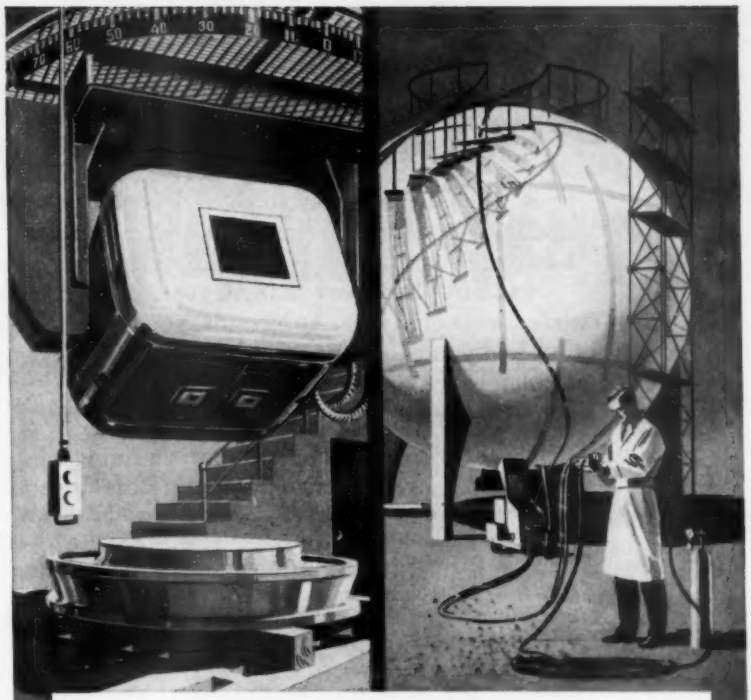
The induction heaters, developed by General Electric Co.'s Industrial Heating Department, helped to slash production time from 3 minutes to 18 seconds. Also, very few rejections are encountered in this controlled atmosphere brazing operation. Production tolerances can be held and temperatures closely controlled within a range of 90 to 3,000 F.

The high-frequency heaters have a variable impedance output that can be matched to the load, rather than requiring the load to be matched to the fixed impedance of the heater. This means that when designing coils, it is not necessary to compromise between a coil which gives the desired heat pattern and one which matches the induction heater.

Instead, the coil is designed for optimum heat pattern, and a dial control used to match the load to the impedance of the induction heater.

Silver brazing, lead-tin alloy soldering, shrink fitting, hardening, tempering and local stress removal in a controlled atmosphere can be handled by the new automatic brazing and soldering equipment and heaters.



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When you buy welding wire from PAGE,

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• The only *sure* way to get a dependable weld—a non-porous weld, free from cracking—is to use a welding wire which will give weld metal compatible with the base metal, and which contains deoxidizers designed to eliminate all impurities.

PAGE has had more than 50 years of experience in the development of welding wires for specific jobs. As a result, you can get the wire best suited to your welding job—and you can get it from local stocks, packaged in the way that fits your own production requirements.

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A choice of 33 analyses of automatic welding wire enables you to get the *exact* wire you need for any welding operation. Here are some examples:

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A-S-6 • for welding mild steel with exceptional ductility—50,000 p.s.i. average tensile, with 35% elongation.

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A-S-15 • an aluminum-killed mild steel which gives a tensile strength of approximately 75,000 p.s.i. with 40% elongation.

A-S-16 • the same as A-S-15, but with molybdenum added for higher tensile strength.

A-S-17 • a modification of A-S-10 with silicon added for use with inert gas.

A-S-18 • the first successful wire for CO_2 welding of high-carbon and sulfur-bearing steels and for general use on low alloys.

A-S-20 • a high-tensile submerged arc rod, also suitable for CO_2 welding.

A-S-25 • a modification of A-S-20, with deoxidizing agents added for better CO_2 welding.

A-S-30 • produces porous-free weld metal, even on a very dirty steel. Contains up to .75% aluminum for maximum deoxidation.

A-S-65 • reasonably priced for hard-facing with high resistance to abrasion or erosion.

A-S-4130 • a medium carbon, chrome-molybdenum alloy for welding the SAE 4100 series of low alloys.

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Metal spray wires generally deposit a coating of the same analysis as the wire employed, and this deposit may be built up to any thickness. The deposit is porous and has little tensile strength, but provides excellent anti-frictional characteristics and resistance to abrasive wear.

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PAGE electrodes are available for use with Armco, mild steel, low alloy and heat-treatable steels, and for impact-resistance surfacing.

GAS WELDING RODS

PAGE gas welding rods are available in any of the analyses for welding wires. Any welding wire grades listed can be furnished in 36″ straight lengths for gas welding rods. Rods also can be furnished in coils and on reels.

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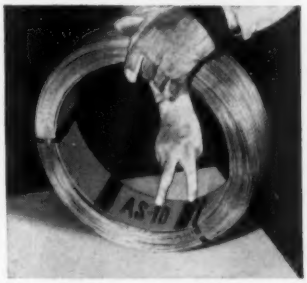
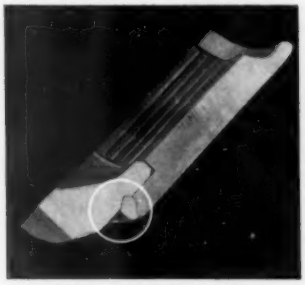
PAGE welding wire, rods, and electrodes are as close as your phone. Prompt delivery is assured from a coast-to-coast network of PAGE distributors backed up by strategically located warehouses.

LET PAGE HELP YOU SOLVE YOUR WELDING PROBLEMS

From our 33 analyses, we usually can prescribe the wire best suited to your requirements. We also can develop special wires when needed to solve a particularly tough welding problem. At all times, PAGE welding specialists are ready to give expert advice. Call on us for help.

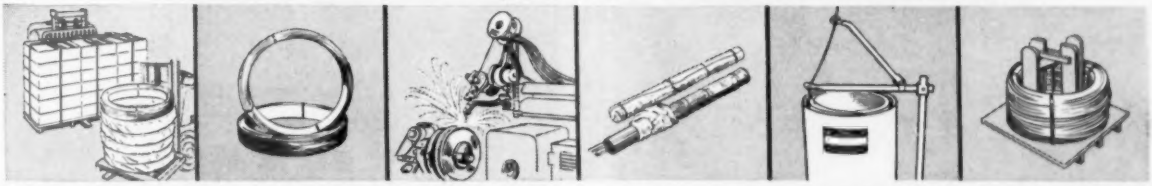
Liner markings on each coil of PAGE welding wire provide positive identification, end mix-ups. And on #2 coils, liners are color-coded as well. The color of the stripe indicates the grade, makes identification double-quick and fool-proof.





Perfect weld of SAE 1141 to SAE 1151 was accomplished with A-S-18, using CO_2, to form an automotive drive shaft. Note clean metal in cutaway portion shown at left. There's no annealing of the high-carbon resulfurized steels, because preheat and post-heat are not required.

PACKAGING TO MEET YOUR REQUIREMENTS



25-lb. or 60-lb. coils, single or palletized—also in single or palletized individual cartons, or in waterproof reusable fiber-board drums.

120-lb. or 180-lb. coils, paper-and-burlap wrapped, or in palletized cartons. Special coil sizes on application.

25-lb. reels (spools) in cartons are designed to fit all standard machines; single or palletized to meet your requirements.

Gas welding rods in 50-lb. paper-and-burlap bundles; in fiberboard cartons of 10 lb.; and in boxes of 50 lb. or over.

Payoffpaks and Leverpaks are furnished with diameters ranging from 15" to 23" and capacities from 25 lb. to 700 lb.

Payoffpallets hold 900-1200 lb. of wire (sizes 3/32" to 3/8" incl.) coiled around pedestal on top of a wooden pallet.

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Write for:

Folder DH-402-0 • Contains information on submerged arc and inert gas automatic welding wire. Lists descriptions and uses of the many PAGE analyses. Describes our extensive variety of packaging.

Folder DH-1218 Chart lists detailed analyses of PAGE automatic welding wires, metal spray wires, bare electrodes and gas welding rods. Shows uses and properties. Lists most competitive makes.

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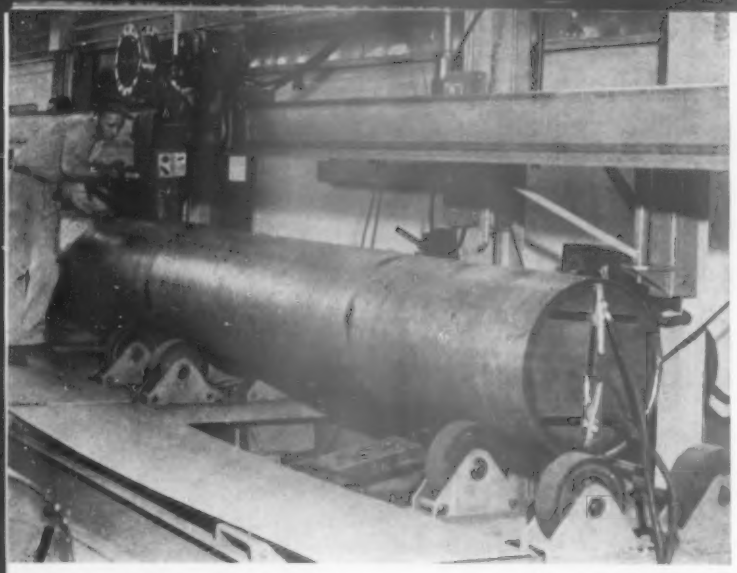
ACCO

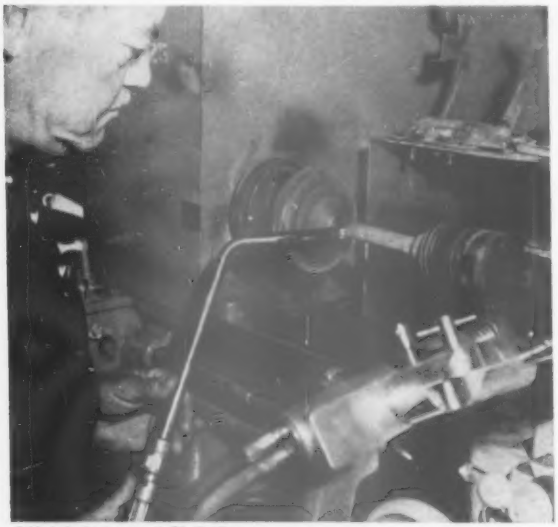
the source for answers to wire problems



WELDOR prepares to make circumferential weld on 24-in. OD casings that will be used to protect steel H-beam piles under $2,000,000 Westport, Mass., River Bridge. Thirty-ft long casings were fabricated from six 5-ft sections of ⅜-in. thick 4-D wrought iron plate. A. M. Byers Co., Pittsburgh, prepared the plate according to ASTM A-42-55 specification. Plate was chosen because it is capable of withstanding severe salt water tide zone corrosion, and because its self-fluxing action enables weldors to produce sound welds equal in strength to parent metal. Casings will envelope steel beams and be filled with concrete for additional pier support. The wrought iron will also be used for telephone and electrical conduit, railings and fender angle points.

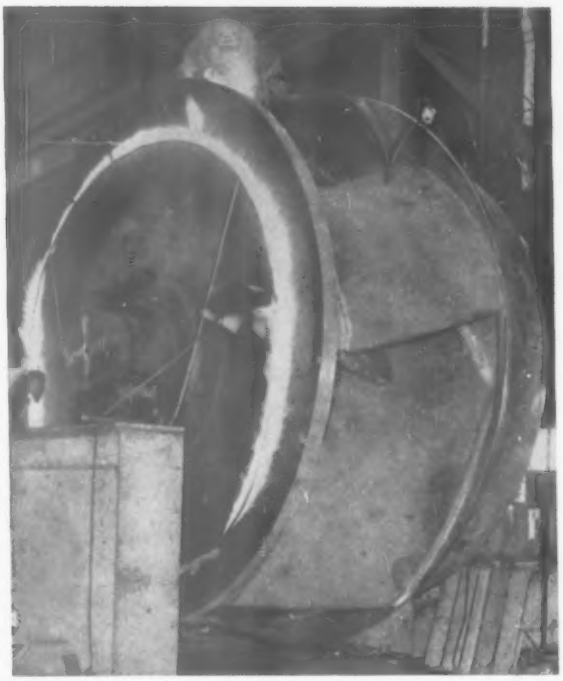
On the job...

A hardfacing procedure used by the U. S. Navy to overhaul and repair exhaust valves has reduced engine maintenance costs more than 85% and has saved the government more than two million dollars during the past three years. Spraywelding is used to apply to stainless steel valve stems a fusion-bonded non-porous overlay. This protects against wear where stems are in contact with valve guides and guards against erosion where stems are exposed to escaping high-velocity combustion gases. Wall Colmonoy Corp.'s Colmonoy No. 6, a nickel base material containing chromium



Official photograph U. S. Navy

borides and carbides, is used. To reclaim, worn valve stems are undercut 0.005 to 0.007-in. to allow for overlay. Machine surface is then grit blasted, and valve is mounted on a special fixture in a lathe. While valve is rotated, a powder form of the alloy is sprayed on. Spray is transversed across surface of valve stem to obtain desired buildup on diameter. As applied, alloy is mechanically bonded to valve stem. Above, mechanically bonded alloy is fused to base metal using oxyacetylene flame, as valve is rotated to insure uniform application of heat and eliminate valve stem distortion.



WELDING vanes to crown of fabricated impeller runner for a reversible pump-turbine produced this pyrotechnical display at Allis-Chalmers York Works. Flames result from heating process used during welding to reduce moisture in metal and safeguard against cracking. This runner is one of 12 reversible pump-turbines company is furnishing New York State Power Authority's Tuscarora plant. It is claimed pump-turbines will provide greater combined capacity as motor-driven pumps and hydraulic turbine driven generators than any other pump-turbine plant in existance. Each unit, as a 37,500-hp motor driven pump, will deliver 3,400 cu ft per minute against a storage pond head of 85 ft.

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It's easy.

Take this job for example. The photo shows a Development Engineering Company weldor joining .062 inch Monel sheets for a corrosion-resisting aircraft testing chamber. To get weld metal to match the corrosion-resistance and strength of Monel nickel-copper alloy, he knew Inco's "130"* Monel Electrode was his best bet.

It's easier and wiser to buy Monel electrodes where you buy Monel sheet – all from the same people who developed Monel* nickel-copper alloy. Who would know how to weld Inco alloys better than the people who developed them?

Wide range of Inco-developed electrodes available

There's a full range of Inco welding products available for oxyacetylene, inert gas metal-arc, and metal-arc welding. From these, the right welding material can be selected to match the properties of any Inco Nickel Alloy you may be joining.

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On your next job make sure you use Inco welding products to join Inco Nickel Alloys. Look under "Nickel" in your classified telephone directory to find out where you can buy Inco welding products.

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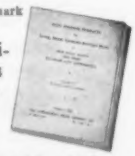

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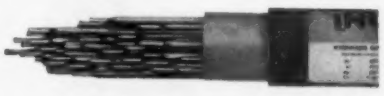

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The DryRod line of ovens now includes four basic models to meet every welding requirement.

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PHOENIX PRODUCTS COMPANY
4727 N. 27th St. • Milwaukee 9, Wis.

by **Eric Holby**

American Indians taking advantage of vocational training program

IN ARIZONA LAST YEAR—a Navajo was tending his father's sheep in a remote area on the Navajo reservation, another young Indian was picking cotton on the Papago reservation to the south. Today, both young men are earning more than $100 a week as certified weldors in a Chicago shipyard.

Hundreds of young Indians, possessing above average manual dexterity, excellent learning ability and a willingness to work, are now relocating, trading their tepees for city apartments.

Two branches of the Bureau of Indian Affairs are conducting programs to raise the living standards of the American Indian. The Branch of Relocation is helping him by providing vocational training and relocating him in areas where jobs are plentiful.

Some Indians do not want to relocate, but want to learn a trade they can practice on the reservation. For this reason, the Branch of Industrial Development is trying to lure industry to reservation areas. In some places, skilled Indians are able to apply their trade in a commercial enterprise operated by their reservation.

Men once had to be imported by the Apache reservation in New Mexico to handle welding on the tribe's oil and gas properties. In order to provide their own people with jobs, the tribal council instituted a welding training program. Tribesmen were first trained under the government program, then returned to the reservation to teach fellow Indians.

LAWRENCE Maho, a Hopi Indian from Fort Difiance, Arizona, on job in Chicago.

Once an Indian decides to apply for relocation and vocational training, he checks with the reservation offices of the Bureau of Indian Affairs. Here, the applicant is given aptitude tests and a physical examination. Then, a schedule is set up for his transportation to one of the seven area field offices.

Upon arrival at the city he has chosen, a counselor helps the Indian select a course of study that is suited to his capabilities and that offers a good chance for employment.

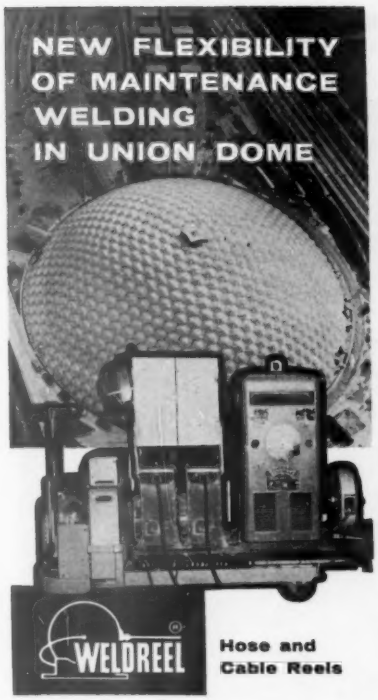
Under congressional act 959, the government pays for the Indian's transportation, tuition and living expenses while he is attending a vocational school.

Lawrence Maho, a Hopi from Arizona, is a relocated Indian. He decided to learn to weld and chose Chicago as the city he wanted to live in. He studied at Greer Shop Training, Chicago, and now is a gas and arc weldor working on high-temperature alloys at the Stanwood Co.—but this did not come about overnight.

A typical day for a combination (gas and arc) welding student consists of 90 minutes of classroom work devoted to welding theory, blueprint reading and layout work, and 4½ hours in the welding shop.

Instruction begins with the use of station regulators, gas savers and the oxyacetylene torch. After the technique has been demonstrated, the student practices making wash beads without a rod. Next, he runs beads on sheet steel with a rod, and subsequently practices closed butt joints and open butt joints.

One week is devoted to the welding of small diameter pipe, ranging from 1 to 3 in., in a fixed position.



AT UNION TANK CAR COMPANY'S new maintenance facility in Baton Rouge, Louisiana, portable welding units like this one, are easily moved right up to the job site by small lift truck. Then welding cable, ground cable and welding hose are paid out as needed from WELDREEL reels.

When a job is completed, hose and cable are quickly rewound onto reels by strong springs, and the entire unit moved to a new location. Not only does this permit maximum use of welding equipment . . . *it also extends life of hose and cable* . . . keeps it off floor when not in use . . . *increases plant safety.*

Designed to handle a wide variety of single and dual hose, and single and multiple cables, WELDREEL reels are available to a wide variety of industrial applications. Write for full information.

MODEL OA-A holds 50′ of 3/16″ or 40′ of ¼″ dual hose. Model OAB has capacity for 150′ of ¼″ or 125′ of 5/16″ hose.

MODEL EA-2 with current capacity of 300 amps holds 50′ of 2/0 welding cable. Model EA has capacity of 100′ cable.

MODEL A-1 has 50′ capacity of ¼″ or ⅜″ I.D. single hose. The larger Model A-2 holds 50′ of ½″ hose.

UNITED SPECIALTIES INC.
POST OFFICE BOX 698 EL DORADO, ARKANSAS

Typical pipe intersections are prepared and welded as are standard butt joints.

Then, instruction in welding different types of castings, including malleable iron, gray cast iron and steel castings, is given. The student is taught how to prepare the casting and choose the best welding procedure. The use of different brazing alloys and fusion welding is covered.

Butt, tee, lap and corner joints on commercially pure aluminum, aluminum alloys and clad aluminums are then practiced. Castings, extrusions and aluminum sheet are also used to give the student a good background.

To complete the eight weeks of gas instruction, a series of test projects are done, and the course reviewed.

Then the student goes on to the arc welding shop, where instruction begins with studying a variety of arc welders, a-c/d-c rectifiers and d-c motor generator sets.

The first arc weld made is the bead on plate using several different classes of electrodes. Butt welds made in flat position, single and multiple pass flat fillet welds, horizontal fillets, and edge welds in the flat are covered in a three-week span. Following this, all position welding of various joints using different electrode classes are practiced.

The final two weeks of the course are devoted to arc welding sheet steel in all positions, and pipe welding standard pipe joints in all positions.

During the four-month course, students are taught joint preparation with an oxyacetylene flame. Standard and special gouging tips, the use of special cutting and chamfering electrodes are also covered.

FRANCIS Dwarf, a Sioux Indian from South Dakota, practices gas welding techniques.

TO MEET the diversified requirements of industry, Leach & Garner (since 1898) has developed a line of over 100 different silver solder alloys. Leach & Garner alloys range from those with narrow melt and flow ranges to those performing special functions, plus meeting standard specifications. An increasing number of customers are finding each Leach & Garner alloy fills a specific need with guaranteed high performance, economy, and rapid delivery.

Available mill forms: Sheet, wire, and cut. Preforms in all sizes and shapes are available on a custom basis from our affiliate General Findings & Supply Company.

For complete information and data on Leach & Garner Silver Brazing Alloys write for Technical Data Sheet No. 501.

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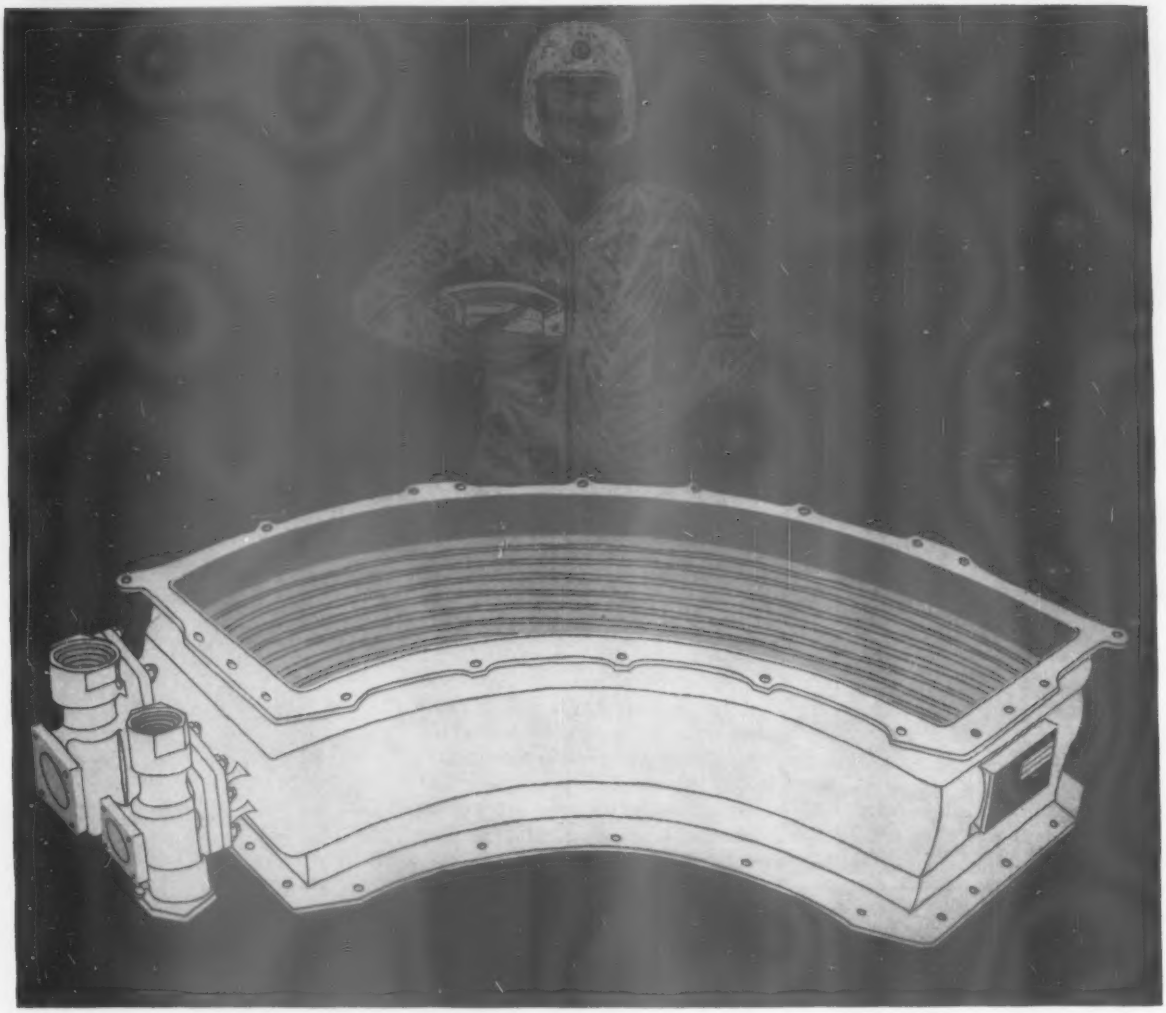
South Wind Division of Stewart-Warner Corporation builds this heat exchanger of Alcoa Aluminum. It is used in such high-performance aircraft as the Boeing B-52 jet bomber. Fins are die formed, separator plates blanked. Unit is then dip brazed to insure uniform quality, strong joints.



DIP-BRAZED ALCOA ALUMINUM HEAT EXCHANGERS GIVE JET-AGE PERFORMANCE, CUT JET-AGE COSTS

An engine oil cooler in a jet engine, often operating at supersonic speeds and stratospheric altitudes, has to be dependable. Joints or fins can't fail. To insure dependability, South Wind Division of Stewart-Warner Corporation builds oil coolers of dip-brazed Alcoa® Aluminum. The result is a strong, lightweight and easily fabricated unit that is produced economically and efficiently.

South Wind has also found that there are other good reasons for using the aluminum dip-brazing process. "We chose dip brazing because it yields the most consistent quality joint," says J. Q. Mosbarger, manager of South Wind's Sales and Engineering Administration. "We also prefer aluminum because it permits a heat exchanger design with 33 per cent less weight, it increases exchanger efficiency three to four times over its closest alternate metal. It is the most economical metal, pound for pound, we could use."

For heat exchangers or for similar applications, dip-brazed Alcoa Aluminum is the ideal solution because it produces complicated assemblies in one-piece, uniformly strong units. Closer tolerances in small parts are possible, and over-all strength can be easily controlled.

Any of the distributors listed at the right can give you full information on aluminum welding and brazing processes. Or, write Alcoa direct for free information and loan of films on joining aluminum. Write to Aluminum Company of America, 1761-H Alcoa Building, Pittsburgh 19, Pa.

Your Guide to the Best in Aluminum Value

ALCOA ALUMINUM

For Exciting Drama Watch "Alcoa Theatre," Alternate Mondays, NBC-TV, and "Alcoa Presents," Every Tuesday, ABC-TV

Want technical help in welding, brazing or soldering aluminum? Contact your Alcoa sales office, listed under "Aluminum" in the Yellow Pages of your phone book.

For immediate delivery of Alcoa welding products, call your Alcoa outlet listed below. He carries a complete range of alloys and sizes.

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Denver
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Milford
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Whitehead Metals, Inc.

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Atlanta
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Mid-South Oxygen Company

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Machinery & Welder Corp.
Steel Sales Corp.

KANSAS
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News shorts . . .

Alloy Rods Co., York, Pa., has recently opened a warehouse at 95 Market St., Oakland, Calif. . . **Superior Propane Ltd.** has acquired the plants and equipment of **Kenebec Propane Ltd.**, Quebec City, and **Nakash Propane** at Thetford Mines, Quebec. . . **National Cylinder Gas Div., Chemetron Corp.**, has placed in operation a transfilling plant at Odessa, Tex. The firm is completing construction of similar plants at Saginaw, Mich., and Tonawanda, N. Y. NCG has also recently opened new Southwestern regional headquarters at 519 Braniff Airways Building in Dallas, Tex. It is managed by P. E. Smith.

"Mill & Factory" magazine has presented **Air Reduction Sales Co.**, New York City, with its June Product of the Month Award for the company's new Dip Transfer CO_2 semiautomatic welding process. **Air Reduction Co., Inc.**, will construct a test laboratory in Franklin Township, N. J., to do research on fuels and oxidizers. The new facility will augment the work of the company's nearby Murray Hill center, where work is to begin on an $87,000 **Atomic Energy Commission** contract to study a technique for handling gaseous beta sources, and do research on properties of Krypton 85.

Sylvania Electric Products Inc. has moved its executive offices to the General Telephone Building in New York City. Remaining at Sylvania's 1740 Broadway offices are the advertising, marketing research and various sales departments, and Sylvania International . . . R. K. Innes, eastern manager of cylinder sales for **Norris-Thermador Corp.**, has moved his offices to 248 Lorraine Ave., Upper Montclair, N. J. . . **Eastman Kodak Co.** is completing a new building and warehouse on a 24-acre site in Whittier, Calif.

Kaiser Steel Corp. is said to be the largest steel producer west of the Mississippi now that it has installed the new oxygen steelmaking process, and completed its $214,000,000 expansion program at its Fontana, Calif., plant. Company's annual ingot capacity is nearly 3,000,000 tons. . . Fifth annual meeting on titanium of New York University's College of Engineering will be held September 14 and 15 on its Bronx Campus. Among sponsors are **Crucible Steel Co. of America** and **Mallory-Sharon Metals Co.** . . . **Norton Co.**, Worcester, Mass., has purchased **Gould & Eberhardt Inc.**, of Irvington, N. J.

Contour Sales Corp., Compton, Calif., has been named exclusive world-wide distributor of the Ang-Lo-Cator Protractor, a device that determines the correct degree of angle of any pipe or structural material. It is manufactured by **Ang-Lo-Cator Inc.**, Long Beach. . . **Zero Mfg. Co.**, Burbank, Calif., has purchased another Burbank firm, **Electronic Welding Co.**

The New England District office of **Arcos Corp.**, Philadelphia, has been moved to 45 Kearney Road, Needham Heights, Mass. . . **Hickinbotham Bros. Ltd.**, recently broke ground for a $35,000 welding supply store in Stockton, Calif. The new facility will include an oxygen storage installation. . . "It's profit time," was theme of the district sales managers' conference recently held by **Belden Mfg. Co.** at its Chicago offices. . . **Aluminum Co. of America** says that all-aluminum coils for air conditioners are becoming more widely accepted. This is due to advanced design techniques and development of a zinc soldering process to join aluminum to itself and to other metals.

Rankin Mfg. Co., Alhambra, Calif., has increased its research laboratories and equipment for analysis of existing and experimental hardfacing alloys. Harry Rankin directs the activities.

Chicago Bridge & Iron Co., Chicago, and **G. & J. Weir Ltd.** of Glasgow, Scotland, have formed Weir-Chicago Bridge. It is a jointly owned subsidiary company which will design, fabricate and erect saline water conversion plants. . . **Reynolds Metals Co.**, Richmond, will supply 18,700,000 lb of aluminum plate and extrusions for 1,205 railroad cars to be built for the **Southern Railway System.**

new products . .

. . use card on page 73

Automated shape cutter

Oxweld CM-60 can flame-cut intricate parts of any length, width or thickness. Standard models can be equipped with 10 torches to cut any width up to 10 ft. Thickness of metal to be cut is limited only by capacity of torches used. It is the first large-capacity cutting machine to be equipped with photoelectric tracing system that automatically compensates for kerf width. A single operator seated at control panel controls tracing, ignition, preheat, cutting oxygen, height adjustment of torches, movement of carriages, and positioning of the tracer. *Linde Co.*

Circle No. 1

Machine weld equipment

Recently added to the line of Aircomatic machine welding equipment are two new heads (Models AMH-D and AMH-E); two controls (Models AMC-C and AMC-D); and two machine barrels (Models AM80-A and AM80-B). The heads are single-motor-driven units primarily for use with CAV and RAV power sources using ferrous and non-ferrous aluminum and hard wires 0.030 to ⅛ in. They are equipped with thyratron controlled d-c motors. Constant wire feed speeds for AMH-E are up to 600 ipm; for Model AMH-D, speeds up to 1,000 ipm. Model AMC-C control unit comes complete with crater filler, meters, push-buttons, gas

Riegel

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TOPS IN DOLLAR VALUE

CHOSEN BY SKILLED WELDERS for extra heat protection, greater finger dexterity, and all-around comfort. Horsehide and "Flextan" leathers stay soft after dry-cleaning. Exposed seams completely welted. Seamless backs.

CHOSEN BY EXPERIENCED BUYERS for soft, sure comfort, longer wearability, excellent price, and quick acceptance in the plant...backed by Riegel's ready service and quick delivery.

COMPLETE LINE for any welding need. Let Riegel's specialists help match the right glove to the job. Ask for free catalog.

HEAVY WELDER No. 997
Top quality green "Flextan", lined for heavy, hot jobs.

WELDERS MITTEN No. 987
Green "Flextan" leather, excellent protection, flexibility of finger movement.

SPOT WELDER No. 897
For lighter jobs, unlined green "Flextan" leather.

GENUINE HORSEHIDE PALM No. 956
Horsehide Palm, clute pattern cut extra long to prevent wrist chafing, and fourchetted for extra comfort and dexterity. Welted and wool-lined for complete protection.

RIEGEL TEXTILE CORPORATION • Conover, N. C.

and water solenoids. It operates on 230 volts, single phase, 60 cycles. Model AMC-D operates on 115 volts. Both machine barrels used with this equipment are rated at 800 amp, d-c, continuous duty cycle. Model AM80-A is water-cooled, model AM80-B is an air-cooled unit. *Air Reduction Sales Co., Inc.*

Circle No. 2

Insulated pipe flanges

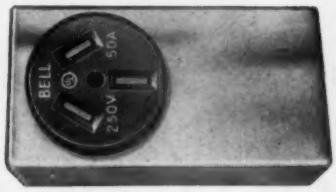
Pre-assembled insulated flange joints in all pipe line sizes are now available. Shop assembly avoids difficulties in the field assembly of insulated flanges used to check electrolytic corrosion in underground piping, and offers such extras as guarantee of zero electrical conductivity. Dielectric insulating gaskets, sleeves and washers prevent the flow of either induced or self-generated current. *Tube Turns.*

Circle No. 3

Semiautomatic process

Arcosarc welding process equipment includes welding gun and semi-automatic wire feed, and can be connected to most welding machines of 500 amp, a-c/d-c capacity or larger. Welding speed is much increased because operator doesn't have to keep replacing stick electrodes. Flux-cored electrode is continuously fed into weld puddle, where it is shielded by CO_2 gas released from welding gun, thus keeping air from the weld area and eliminating porosity. Less edge preparation and fit-up is necessary. The equipment is portable and can be used where automatic set-up is impossible. Designed for welding mild steels up to 75,000 psi tensile strength. *Arcos Corp.*

Circle No. 4



Power outlets

A line of metal-housed, surface-mounted power outlets is now available in steel or aluminum housings. Receptacles are interchangeable, either 30 or 50 amp, within the same housing, thus saving re-installation costs when an amperage change is required. Receptacles are of bakelite, 250 volt, three wires. No. 161, the 30-amp has an L-shaped grounding slot. No. 163, the 50 amp, has a straight ground slot. *Bell Electric Co.*

Circle No. 5

Special liquids pump

New model is a standard Worthington pump with special modifications to provide severe low-temperature service. For example, it handles liquid oxygen at minus 297 F, its atmospheric boiling point. *Worthington Corp.*

Circle No. 6

FOR WORK IN A CONTROLLED ATMOSPHERE

BLICKMAN
VACUUM DRY BOX

Designs and specifications are available for a variety of welding enclosures for research and production welding, and for work in the fields of metallurgy and physical chemistry. These enclosures can be fully evacuated and then be filled with an inert gas for welding in an inert atmosphere. Write for Technical Bulletins on various types of welding enclosures: S. Blickman, Inc., 3308 Gregory Avenue, Weehawken, N. J.

BLICKMAN
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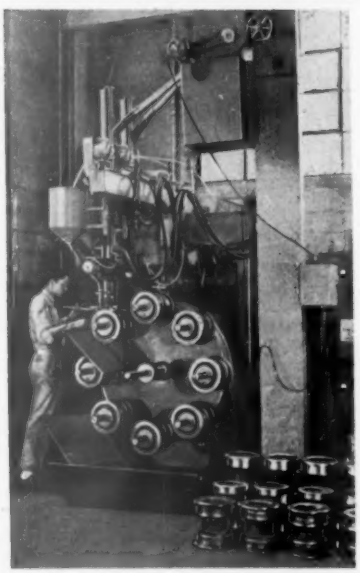
Look for this symbol of quality Blickman-Built

Revolutionary *Rexarc* Enables High Speed Production in Tractor Roller Rebuilding



(Pictured Above) A complete *Rexarc* installation at Michigan Tractor & Machinery Co., Detroit, Michigan.

Here is the new *Rexarc* MS-8 Automatic Twin Head Roller and Idler Welder and Positioner that mounts 8 rollers at a time. Hydraulic indexing enables virtually a continuous automatic welding operation. Twin heads build up both sides of roller simultaneously.

•

Factory engineer trains your operator, assuring excellent results from the very beginning of welding operations, at no additional cost.

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The new Rexarc Automatic Flux Circulating System assures profits unlimited. An adequate flux supply is maintained automatically at all times, eliminating manual flux handling. The operator just empties a new bag of flux occasionally onto the vibrating screen—that's all.

Phone, Wire or write today for complete information about this revolutionary profit-maker.

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Welding Accessories
by LINDE
Oxweld GOGGLES

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OVER EYEGLASSES

OXWELD No. 24 Coverall Goggles have enlarged eyecups which fit over eyeglasses. They give *comfortable* eye protection with excellent visibility—minimizing eyestrain and fatigue during welding and cutting. Frames are lightweight, heat-resistant nylon plastic with vents around lens rings for full, non-fogging ventilation. The rigid metal bar permits goggles to be raised with one hand. The standard Type "AA" green filter lenses are available in Light, Medium, or Dark shades.

Oxweld GLOVES
LONG GAUNTLET PROTECTION

Made of tough, flame-resistant suede leather, these OXWELD Long Gauntlets are 13⅜" long to provide full protection for wrists and forearms as well as hands. They are unusually soft and comfortable.

See your LINDE supplier for prompt service and a complete line of job-proved, quality equipment and accessories for every oxy-acetylene welding and cutting need. Or write for his name and address to LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y.

Linde TRADE-MARK
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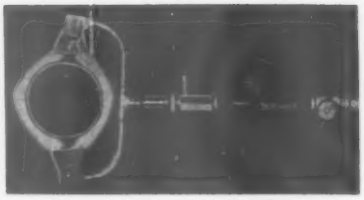

Gas torch

New type Insto-Gas torch, DWV No. 80, is said to do a faster, more economical job of sweating DWV copper pipe fittings in the 3 to 4-in. size. Torch is designed to throw a V-type flame from both burners that make a complete wrap-around of the fitting. Manufacturer says danger of hot spots in soldered fitting is eliminated. Torch operates without pressure regulator and carries UL approval. Dimensions are 15½-in. long by 9-in. wide. Weight is 30 oz. *Insto-Gas Corp.*

Circle No. 7

Oxygen transport

Liquid-oxygen truck transport, Liqua-Guard 2100L, is fully integrated mobile unit. Features an all-aluminum jacketed tank with reinforced plastic cab and body trim. Both pumps are driven by mechanical power take-off. It provides high ratio of payload to gross vehicle weight, it is claimed. *Cambridge Co.*

Circle No. 8

Zinc soldering

Alcoa says its research engineers have perfected the zinc soldering process for joining aluminum to itself and to other metals. Process is said to be superior to brazing for some applications. Company advises use of Alcoa 81 or 82 soldering sheet, 805 solder, and 66A or 67 flux to perform the zinc soldering process effectively. *Aluminum Co. of America*

Circle No. 9

Stud welding gun

Manufacturer claims this welding gun, Model R, to be the smallest stud welder made. Gun is said to handle studs through ½-in. diameter base, and will weld smaller studs to sheet metal. Shaped like a revolver, gun is 6-in. long and weighs about 3-lb. There is just one prefabricated assembly inside, and arc adjustment is done externally. *Shielded Stud Welding Co.*

Circle No. 10

Portable shield

New portable safety shield is designed for welding and other operations. Comes in four standard sizes, and has several unique features. Curtain of heavy-duty olive drab duck is treated with UL approved Hooper Fire Chief flame-resistant finish. Curtain wraps around metal frame and is secured by rust proof snap fasteners. Steel connecting rods are of rust proof, black oxide finish. Shield can be assembled in 3 minutes; no tools are needed. Singer portable safety shield is water and mildew resistant. *Singer Glove Mfg. Co.*

Circle No. 11

Tooling material

New aluminum sandwich core material is useful in the construction of many types of production tools, including welding jigs, holding fixtures, etc. Multiwave tools are made up of sandwich panels, with thin skins of reinforced plastic on both sides of the hollow corrugated aluminum foil, which readily molds itself to shape of part over which the Multiwave panel is being formed. Construction cost is claimed to be about one-half of conventional laminated-plastic tooling. *Narmco Resins & Coatings Co.*

Circle No. 12

Straightener

Multi-purpose straightener tool, Straight-O-Flex, is said to take the drudgery out of the old way of using sledge hammer and block. Tool weighs only 22 lb. Can be used to take out humps in pipe rail at weld points. Frame width is 19-in., height is 11-in., and lever is 26-in. long. Other sizes are being developed, and special adaptations may be ordered. *Architectural Iron Inc.*

Circle No. 13

Small hose clamps

Available with either thumbscrew or slotted screw, No. 5206 and 5306 Hy-Gear hose clamps will go down as small as ⅜-in. diameter, for such applications as welding hose. Bands and housings are of 18-8 stainless steel. *Ideal Corp.*

Circle No. 14

Brazing alloy

This silver-copper-phosphorous alloy, Phos Sil 6F, does not require flux on copper or copper alloys. It starts to melt at 1185 F and has brazing range of 1225 to 1300 F. Alloy is said to be extremely fluid and have exceptional wetting qualities. AWS specification is BCuP-4. *American Brazing Alloys Co.*

Circle No. 15

Goggle respirator

New full-face combination goggle and respirator, named Drednaut, has double facial seal to stop exhaled air from reaching the goggle section. Goggle mask is constructed of flexible rubber, and internal molded ridge separates goggle section from respirator section. Thirteen sets of cartridges and filters are available for protection against gases, fumes, dusts, etc. Drednaut mask fits over all types of personal glasses; goggle section has 0.060-in.-thick acetate lens. *American Optical Co.*

Circle No. 16

Electric-started welder

Gasoline engine driven welder power plants (AEA series) now come with optional electric starters. System has Bendix drive automotive-type starter, uses 12-volt battery. Available in models AEA-220-E and AEA-200-LE. *Miller Electric Mfg. Co., Inc.*

Circle No. 17

Wear-resistant alloy

Named Ampcoloy 666, this extruded manganese bronze alloy is intended for long-wearing applications. It is produced entirely from continuous-cast billets, and is said to be ideal for high production runs in automatic machines. *Ampco Metal, Inc.*

Circle No. 18

FOR A COMPLETE LINE OF INDUSTRIAL GASES, WELDING EQUIPMENT AND SUPPLIES

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He is a welding specialist and has the technical knowledge and experience to help you with your welding and cutting problems.

Every authorized LINDE Distributor is an independent local businessman and carries a complete line of quality equipment and supplies—to give you prompt service.

A telephone call to your nearby LINDE Distributor will bring you the benefits of more than 50 years of LINDE COMPANY's pioneering and leadership in welding and cutting. If you don't know your local LINDE Distributor, look in your classified telephone directory. Or write for further information to LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited, Toronto.

Linde UNION CARBIDE

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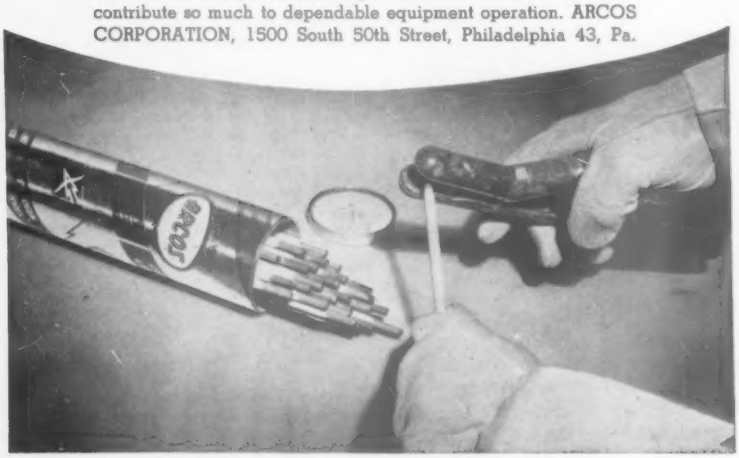
Job Report Courtesy of
Globe Fabricators, Inc., Paramount, Calif.

When stainless welds must be highly sanitary and corrosion resistant

WELD WITH ARCOS

STAINLESS ELECTRODES

Welded citrus fruit processing equipment such as this must *resist corrosion*, must *not contaminate* the food and must be *strong*. Type 304 stainless, used for all food contacting sections, was welded with Arcos Chromend K (Type 308) electrodes. For welding the non-stainless supporting members to stainless sections, Arcos Chromend HCN (Type 310) electrodes were used. Again, Arcos electrodes provided multiple benefits that cost so little and contribute so much to dependable equipment operation. ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Pa.



Air-cooled Tig holder

New pencil-type manual holder is for Tig welding of light gage ferrous and non-ferrous metals. Smallest unit in company's line, it is rated at 100-amp, continuous duty cycle, a-c or d-c. Designed for fabricators who work with metals ⅛-in. thick and below, holder accommodates tungsten electrodes from 0.020 through 3/32-in., in lengths up to 3 in. Holder assembly is equipped with nuts and glands for easy maintenance. *Air Reduction Sales Co.*

Circle No. 19

Cutting electrode

New carbon-graphite electrode is said to greatly improve carbon arc-air jet cutting and gouging work. Keen-Cut electrode is designed for maintaining maximum current capacity with minimum current consumption. Manufacturer says it will last much longer than ordinary carbon or graphite electrodes, because it can remove more material in shorter burning time. Available are black, or copper coated, 12-in. lengths, in all standard diameters for operation in the 150 to 1400-amp range. *Becker Brothers Carbon Co.*

Circle No. 20

Ignitron

Addition to firm's line of industrial tubes is the "Jumbo C" ignitron, designated NL-1009, which has 40% more capacity than the size C. Tube has copper cooling coil construction which allows a long averaging time, and elimination of sediment deposits that restrict water flow. Ratings are: anode voltage 250-600 volts; maximum averaging time, 19.1 sec at 250 volts and 9.6 sec at 500 volts. The NL-1009 will fit in either 600 or 1200-amp frame contactors. *National Electronics Inc.*

Circle No. 21

Blast cleaning nozzles

New Norbide-lined venturi style blast cleaning nozzles are said to give the ultimate in production. They are designed for use with all abrasives, especially with silicon carbide or aluminum oxide. Expected life with sand is 750 hours; with steel grit or shot, 1500 hours. Orifice diameters range in size from 3/16 to ½-in. All are threaded with 1¼-in. straight pipe threads, and are jacketed in shock-resistant steel tubing. *Clementina Ltd.*

Circle No. 22

Flame-cutting nozzles

New selection of flame-cutting nozzles for use with acetylene or fuel gas are claimed to give increased speed of cutting. Included in the new Oxweld series are bendable nozzles for riser removal and nozzles for fin washing, general-duty cutting, and high speed mechanized shape-cutting. *Linde Co.*

Circle No. 23

Shop exhaust system

Named Dual Tab-L-Exhauster, system pulls out all welding fumes directly from their source, it is claimed. Receptor exhaust inlets have magnet-bases, that hold fast to the piece being welded, or any convenient metal nearby. Suction from a fan system suited to individual shop requirements draws off gases, fumes, smoke and heat. *Car-Mon Products, Inc.*

Circle No. 24

Silicon rectifiers

Manufacturer claims several advantages for latest improved design 50-400 PIV K-M type 25-35 amp miniaturized silicon rectifiers. The units, available with positive and negative bases, are designed to replace selenium rectifiers in similar performance ranges. Among applications are welding equipment, plating equipment, etc. These silicon-diode rectifiers are said to be virtually unaffected by age or temperature. *Audio Devices, Inc.*

Circle No. 25

Rebuilding machine

Model DEMS roller and idler rebuilding machine features a 150-lb flux container on fixture carriage. Flux pick-up nozzle, attached to each of two wire feed welding contractors with flexible hose, picks up unfused flux and dust during welding operations. Machine has cantilever arm with two 4-spindle units for mounting eight rollers or two idlers; two wire feeders; 360-deg rotation of cantilever arm; module designed welding controls. *L & B Welding Equipment, Inc.*

Circle No. 26

Improved C-clamps

Clamp bodies are hardened through a continuous furnace, quenched in mineral oil, and tempered, to provide tensile strength of 100 to 120 psi. Clamp spindles are also heat treated and entire assembly is treated by Carbo-Nitrating Process. Finished clamps, equipped with loss-proof Perma-Pad swivels, are claimed to be permanently maintenance-free. *Wilton Tool Mfg. Co., Inc.*

Circle No. 27

Hand tachometer

Lightweight, inexpensive speed measuring instruments are said to have an accuracy of ± 1.0%. Known as Magna Tak, they are made in Western Germany, have only two moving parts, weigh less than 9-oz, and are available in these ranges: 2,000, 4,000, 6,000, and 8,000 rpm. *Boulin Instrument Corp.*

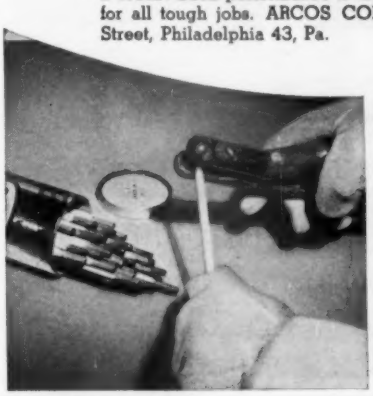
Circle No. 28

Job report courtesy of
Midwest Piping Co., Inc., St. Louis, Mo.

When stainless welds must pass the most rigid tests possible

USE ARCOS QUALITY FILLER METALS

This 16" diameter Type 304 stainless elbow is part of the reactor cooling system in an atomic powered ship. In welding the two halves, the first pass was made with Arcos Chromend K (Type 308) electrodes. The balance of the joint was submerged arc welded with Arcosite Bonded Flux and Chromenar K (Type 308) wire. The inset shows results of a dramatic test of the Arcos weld metal so produced. A 2½" ring, cut from an elbow, was given the normal bend test—and then completely flattened—without a crack! Such performance is the reason why Arcos is preferred for all tough jobs. ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Pa.



Arcos Chromend K
(Stainless) Electrodes

Arcos Chromenar K Bare Wire
and Arcosite Bonded Flux

New TUFFALOY MUCH IMPROVED Tip Holders

For long life and ease of maintenance, TUFFALOY Series "E" straight ejector-type holders combine top performance with great simplicity of design.

The entire sturdy brass head, with its attached ejector tube, is forced into the barrel to eject the welding tip. Two rubber water seals prevent leakage. They are placed inside the barrel, hidden from dirt and damage. This design eliminates the small, easily distorted ejector plunger extending through the stationary head of most holders now on the market.

A threaded coupling holds head and barrel together, and permits the head to swivel freely. Loosen the coupling, even without removal from the machine, for inspection and maintenance.

Made in twelve models: barrels are 8" and 12" long, 1", 1¼" and 1½" diameter, and hold No. 1 and No. 2 Morse taper tips in threaded adapters, furnished as part of each holder. Adapters are RWMA class 2 alloy to reduce wear of the tip socket.

TUFFALOY Resistance Welding Alloys are widely available through AIRCO and TUFFALOY representatives. Call on them for Spotwelding Tips (Standard, TUFFCAP, Cold-Bent, and Special), Holders and Adapters, Bar Stock, Forgings, Seam Welding Wheels, and all other welding alloy needs. Ask for Catalog and Price List.

AIRCO

AIR REDUCTION SALES COMPANY
A Division of Air Reduction Co., Inc.
150 East 42nd Street, New York 17, N.Y.

ANNOUNCING!

A NEW METHOD
Of Connecting Welding Cable

T.P.C.*
Pat. Pending

***THREADED POWER CONNECTION**

Trim insulation — allow ¼" to extend through sleeve

Slip on threaded sleeve

Crimp sleeve with Swedg-on tool

ASK YOUR **HI-AMP** DISTRIBUTOR
TO EXPLAIN
THIS NEW—EASILY ATTACHED—
COOL RUNNING CONNECTION

Lenco, Inc. **P.O. Box 189** **Jackson, Mo.**

Automated Tig welders

New series of automatic Tig welding machines can be adapted to various types of longitudinal seam or rotary circumferential welding. Picture shows circumferential machine automatically welding circular bottom plate into a coffee maker body. Argon gas is introduced beneath weld through fixture to prevent forming of oxide and produce smooth weld bead. Both this machine and a longitudinal seam welder are based on concepts and specifications of the Linde Co., New York City, but designed and built by *Expert Welding Machine Co.*

Circle No. 29

New belt drive

New tooth-grip principle, Positive Drive, belts and pulleys are said to combine the advantages of chain and gear with those of the belt. Molded teeth on the belt are designed to make positive engagement with mating axial grooves on the pulleys. They are adaptable to virtually every kind of power transmission drive, for speeds under 100 fpm to over 10,000 fpm, and on drives up to 600 hp. *Worthington Corp.*

Circle No. 30

Safety goggles

New Eyegard package contains 12 individually boxed goggles. When outside package is placed on shelf, the perforated carton ends should be torn off to leave neat opening. Ends of individual boxes are thus revealed, and aid easy identification. *Safety Equipment Co.*

Circle No. 31

Mending compound

Met-L-Urge is a metal mending compound that mixes easily in any quantity with water. It is said to bind securely to metals, wood, ceramics, glass and concrete, and manufacturer says it can be used to make forming dies, metal working fixtures or as repair agent. *Schmidgall Laboratory.*

Circle No. 32

Bench shear

Edwards Handy No. 1 bench shear weighs only 8 lb and is easily taken from job to job. It will cut rods up to 5/16-in. dia, sheet steel up to 3/32-in. thick in any length or width. Cutting blades are easily removed and re-sharpened. *Edwards Mfg. Co.*

Circle No. 33

Heavy-duty positioner

PM-1051 work positioner was developed to meet the problem of positioning heavy, odd-shaped work for welding or fabrication. Its 32-in. (42-in. optional) table rotates a full 360 deg in either direction. Rotation speed is variable from 0 to 4 rpm. It will handle titanium and other super-alloy weldments up to 2,000 lb. *Boesch Mfg. Co., Inc.*

Circle No. 34

Production welder

Magna-Tran line of electric production welding machines have magnetically controlled transformers which permit full range output by rotation of single dial. Plug-in type timing devices permit multi-purpose use of welder by selection of up to 12 different operating control combinations. Unit may be controlled from panel or from remote position by hand or foot-operated rheostat. Replaceable plug-in type panels, valves and timers minimize repair downtime. *Mid-States Welder Mfg. Co.*

Circle No. 35

Copper alloy

Composed of copper and zirconium, Amzirc is a new alloy that can be used for resistance-welding wheels and electrodes, soldering iron tips, etc. It has high softening point of about 600-deg C., at which point it has high conductivity, good ductility. At present time, round rod and wire can be supplied "as drawn" or as "drawn and aged" in diameters from .028 to 1.0-in. *Bridgeport Brass Co.*

Circle No. 36

Variable size goggle

New-type plastic hooks slide in and out of temples for easy adjustment by the wearer. This Retrax feature, plus a universal nose bridge, makes it possible for one size goggle to fit all workers. Tuc-Away goggles also feature snap-in, interchangeable heavy impact lenses, which may be replaced by wearer. *Watchmoket Optical Co., Inc.*

Circle No. 37

Versatile alloy

Phos Sil 6 is excellent for joints with poor fit-up, has a sluggish flow range and produces a strong ductile joint. Composition is 6% silver; 88% copper; 6% phosphorous. Alloy has a brazing range of 1275 to 1350 F. AWS specification is BCuP-3. *American Brazing Alloys.*

Circle No. 38

If you haven't yet read the interesting facts about the newest advancements in acetylene cylinder manufacture — call us now (collect) — or write and let us send you the enlightening folder about the ALL NEW COYNE 92 ACETYLENE CYLINDER.

COYNE cylinder company

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H&M PIPE CUTTING & BEVELING MACHINES

H&M Pipe Cutting and Beveling Machines provide quick, efficient, automatic preparation of pipe for welding . . . with savings up to 50% over the cost of manual cutting. Lightweight H&M Machines are easily operated by one man and even inexperienced operators give excellent results after only a few minutes instructions on an H&M.

The H&M line, with seven models for 1½" thru 36" pipe, is the right way to put more profit into your pipe cutting operations. Contact H&M for full details.

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SEMI-AUTOMATIC WIRE

new MANGANAL®

11% - 13½% MANGANESE - NICKEL STEEL

SOLID SEMI-AUTOMATIC WIRE

1. Higher deposition rate. (12 lbs./hr. on high amperage)
2. Higher build-up.
3. Cannot kink and crush in feed rolls.
4. Practically no spatter.
5. 25 lb. coils, 7/64" diameter.

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STULZ-SICKLES CO.

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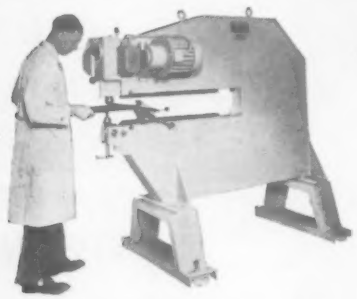
NOW! BUY ONE PULLMAX MACHINE



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Beading

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Irregular or Freehand

Edge Bending

Nibbling

Flanging

Slot Cutting

Joggling or Offsetting

Inside Square Cutting

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Circle Cutting

Now you can do all this work on one machine—save time, labor and material as well as expensive die costs. Cuts mild steel up to 13/32". 8 sizes of machines to choose from.

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Ear protector

A new concept in maximum ear protection, Quiet-Ear, was developed by RCA to serve personnel who work near loud noises. It is lightweight, sanitary and inexpensive; sealing shells are not overly large and headpiece is adjustable. *Bausch & Lomb Optical Co.*

Circle No. 39

Water-saving control

The Water Mizer is a low-priced water saving control for resistance welders. Functions as short proportioning time delay, which operates in conjunction with one or more thermostats. It can be used with a single solenoid valve or the Hi-Lo manifold. Model ES-10 control is equipped with a ½-in. solenoid valve and a surface mounting thermostat. *Van Vooren Products*

Circle No. 40

Link chain hoist

New lightweight electric hoist, Midget King, is equipped with durable, alloy type link chain which flexes in any plane to pick up material not directly under the hoist itself. Both this new link-type, and roller chain models are available in ⅛, ¼, ½, 1 and 2-ton capacity models. Hoists in all capacities come in hook or trolley types. *Yale Materials Handling Div.*

Circle No. 41

Automated soldering

New Flowsolder Production Line, it is claimed, provides faster, better soldering of printed circuit boards or other electronic component assemblies. The process provides continuous, straight-line, single-level processing of components up to 9½-in. wide, and up to any particular length. *Electrovert Inc.*

Circle No. 42

Brass adaptors

Three new additions have been made to company's line of brass fittings. Adaptor No. 321 (L-shape) adapts MC tank to POL acetylene regulator, No. 322 adapts MC tank to commercial acetylene regulator, and No. 324 (straightline) adapts MC tank to POL acetylene regulator. *Western Enterprises Inc.*

Circle No. 43

About people . . .

A. W. Sawyer, Jr.

C. G. Herbruck

Lincoln Electric Co., Cleveland, has appointed *Ansley W. Sawyer, Jr.*, director of advertising and sales promotion. At the same time *Charles G. Herbruck* was named assistant secretary, public relations and publicity. He will also direct the company's educational activities.

Major changes have been made in the sales department of the Welding Products Div., A. O. Smith Corp., Milwaukee. *A. E. Johnson*, formerly chief engineer of the firm's Elkhorn, Wis., plant, is now sales manager in charge of welding machines. He also has responsibility for the division's advertising. *A. R. Schneller*, former welding machine sales manager, is manager of the Milwaukee district. *R. N. Stime* has been named the company's assistant director of merchandising. *L. G. Crowley* is the new manager of the southern region, headquartering in Memphis.

Harnischfeger Corp., Milwaukee, has announced the appointments of *William L. Carter* as treasurer and *James M. Mezera* as controller. Carter was assistant treasurer, and continues to be secretary and treasurer of both Harnischfeger Export Corp. and Harnischfeger Credit Corp. Harnischfeger's Welder Division has added two sales staff representatives: *Paul H. Peterson* will cover southern half of Chicago and parts of Illinois and Indiana; *Alfred O. Neil* will cover northern half of Chicago and upper portions of Illinois and Iowa.

Edward T. Scott, Jr. has been elected vice president and appointed assistant to the president in charge of sales training for Scott-Tarbell, Inc., Cleveland.

E. R. Joseph Co., Inc., Norristown, Pa., has appointed *Jerry Rapine* manager of the firm's Morey Flux & Chemical Div., Wilmington, Del.

NATIONAL CARBIDE
IN THE RED DRUM

HIGHEST QUALITY

DUST FREE

DEPENDABLE SUPPLY

Write for the name and address of the NATIONAL CARBIDE supplier nearest you.

National Carbide Company
A DIVISION OF AIR REDUCTION COMPANY, INCORPORATED
GENERAL OFFICES: 150 EAST 42ND STREET, NEW YORK 17, N. Y.
AT THE FRONTIERS OF PROGRESS YOU'LL FIND AN AIR REDUCTION PRODUCT

King Arthur claims:

Model 1450

"I don't jest when I joust, no foolin' Dockson HELMETS are ye best for protection and comfort."

Model 1475

Model 1225

Complete, comfortable protection against sparks, flash and dangerous rays. Light, roomy, adjustable, easy, one-hand raising. Stays where you want it.

Built to last of tough, one-piece, rivetless, moulded fibre.

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There's a style to suit your need. Write for catalog 56-06.

3839 Wabash Ave., Detroit 8, Mich.

BECKER
Keen-Cut Electrodes

for use in CARBON ARC-AIR JET GOUGING

KEEN-CUTS—for the best characteristics of carbon and graphite in a carbon arc cutting electrode. Higher current capacity . . . longer life . . . shorter cutting time . . . greater material removal . . . smooth surface gouge . . . controllable accuracy . . . hot stable cutting arc . . . elimination of smoke and gases.

And they're low in cost. Try BECKER KEEN-CUT ELECTRODES—black or copper coated, standard diameters, 12" lengths in 150 to 1400 amp. range—for the most efficient, labor-saving electrode in carbon arc/compressed air cutting.

A COMPLETE LINE OF CARBON AND GRAPHITE WELDING SUPPLIES—carbon and graphite electrodes, carbon rods and plates, welding paste, graphite cores and chills, graphite powder and particles of any mesh.

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MATERIAL HANDLING DEVICES

- Safety Factor—5 to 1
- Factory tested at triple rated capacity.
- Will lift from horizontal or vertical position.
- Cam and Pads of case hardened tool steel.
- All operating parts replaceable when worn.
- Swinging or jerking loads will not affect grip.
- Useful for positioning in welding operations.

The HEAVIER the LOAD • • • the TIGHTER the GRIP! 3-T-17

MERRILL BROTHERS

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Twining, Jr

Bradley

E. S. Twining, Jr., formerly manager of gas department marketing, has been appointed vice president of marketing, by Air Reduction Sales Co., New York City. Twining has held various sales management positions during his 14 years with the firm. *G. L. Werly, Jr.* succeeds Twining as manager, gas department-marketing.

William J. Bradley is now factory manager of Superweld Corp., North Hollywood, Calif., and a member of the management committee. *Kenneth L. Madden* has been named manager of quality control.

Rankin Mfg. Co., Alhambra, Calif., has appointed *Harry Rankin* to direct research and product development activities in the field of hardface welding.

J. Stuart Anderson has been elected assistant to the vice president, and also assistant treasurer of The International Nickel Co. of Canada, Ltd. He has also been made assistant vice president and assistant treasurer of The International Nickel Co., Inc., New York City.

Thomas M. Bohnen retired from active service with Whitehead Metals, Inc., New York City, on June 30, 1959. He was the first employee of the Whitehead Co. upon its formation in Boston in 1914. Bohnen will continue as honorary chairman and honorary director of the company.

A. C. Johnson, southwestern region manager of Linde Co., New York City, recently retired after 40 years of service. Since 1927, he had been in charge of Linde sales activity in an area of 10 southwestern states.

Lewis Welding & Engineering Corp., Bedford, Ohio recently filled two elective offices. *Clifford E. Allison* was elected vice president and treasurer; *Edward W. Hollis* became vice president and general sales manager.

Synnott

Parks

Raybestos-Manhattan Inc., Passaic, N. J., has named *S. J. Synnott* general marketing manager of Industrial Rubber Products. He will direct activities of industrial rubber marketing managers assigned to specific groups. *R. B. Parks* has been appointed assistant sales manager for Industrial Rubber Products and Packings. He was formerly San Francisco District Manager.

Herbert A. Frankel has been appointed New York State regional sales manager for Narda Ultrasonics Corp., Westbury, N. Y. A new Chicago office and warehouse will be supervised by *Marvin Klein* and will service the Great Lakes area.

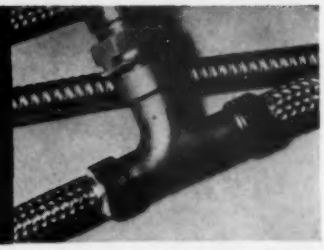
Hugh F. Colvin of Consolidated Electrodynamics Corp., Pasadena, Calif., recently resigned as vice president and director in order to spend full-time as a consultant for technically oriented companies. Colvin has served in various posts with Consolidated since 1947. He is currently a director of Unitek Corp., Pasadena.

The Champion Rivet Co., Cleveland, has appointed *Lew Van Auken* as district manager, Cincinnati area. His territory will be southern portion of Ohio, northern Kentucky, and southeast portion of Indiana. *Kenneth Lee* has joined the sales staff of Champion Rivet's western plant, East Chicago, Ind.

H. W. Saunders retired after 41 years of service, 27 of them as district manager and vice president, Air Reduction Pacific Co., San Francisco. He will be succeeded by *L. A. Hamilton*, vice president of the Seattle, Washington, district.

George Richard Archer has been named chief engineer, Electronic Controls Section, The Budd Co., Philadelphia. Archer joined the company in 1952, and most of his efforts have been directed toward welding controls. *John Burke Collard* has been named sales manager of Electronic Controls Section.

SOLDERING PROBLEM?
stainless to aluminum?
aluminum to copper?
cast iron to steel?



BOEING 707 Landing Gear Harness
Braided stainless steel wire and flexible conduit had to be joined to cast fittings. Brazing burned the fine wire. ALL-STATE had a special solder which solved the problem. (See #430, below.)

You get high strength with ALL-STATE special solders

#7 Special solder for cast iron 450-600°F. Withstands 1000 psi P.

#37 Developed for joining aluminum with soldering iron at low 450°F. Good color match and corrosion resistance. Also joins dissimilar metals. 1000 psi P.

#39 Special solder to join all types of aluminum for both build-up (450°F) and capillary flow (650°F) – with or without flux. 8000 psi T.

#55 Newly developed aluminum "rubbon"® solder – NO FLUX – 705°F – 20,000 psi T. All aluminums.

#105 Special medium temperature alloy for both ferrous and non-ferrous metals (640-740°F) – to 25,000 psi T.

#107 The finest made to join aluminum to steel, copper and brass – or to each other (480-600°F) – to 25,000 psi T.

#430 NO LEAD, NO ZINC or CADMIUM – develops tensile strengths of 10,000 to 28,000 psi on stainless and dissimilar metals. For soldering iron at a low 430°F.

Send for ALL-STATE Instruction Manual. ®RUBBON is a registered trade name.

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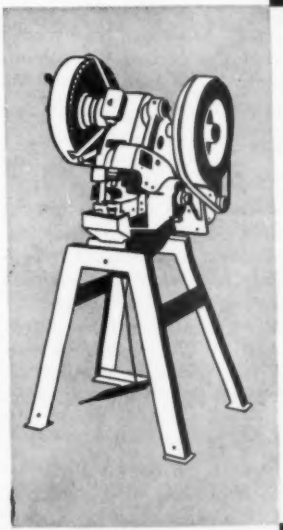
BATEMAN
BANTAM
IRON WORKER



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No Grinding Necessary After Cut. One Stroke Cycle Clutch Operater by Hand or Foot

The Bateman "Bantam" cuts 2" x 2" x ¼" angles and ¼" x 4" flats. Standard punches will fit this machine. The Coper will cope 1¼" through ⅛" material. It will punch ½" hole through ¼" material. With the clutch open, the Bantam will make 44 strokes per minute. It is made of high-grade cast iron, with the clutch, pin and dog made of hardened steel. The blades are made with tool steel. It is powered with a fly wheel and gear drive, and uses a small ¾ hp motor, 1750 rpm.

Bateman Bantam with punch....$575.00
Shear only $495.00
Shipping wt. 750 lbs.

WRITE TODAY for complete information and name of nearest distributor

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the fabricators
SUPER MARKET
Everything
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Over 400 designs to choose from.

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Great traffic and profit builders, many styles to choose from.

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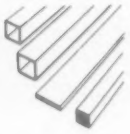
From one tube to a mill lot.



PAINT
Specially designed for O. I. use.

WELDING RODS
Give spatter-free welds require little clean-up

MACHINE TOOLS AND SUPPLIES
Everything your shop would need.

OVER 400 CASTING DESIGNS
Orders shipped same day, by air if requested.

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TFC ®

TENNESSEE FABRICATING CO.
1441 Grimes St. Memphis, Tenn.

American Hard Rubber Co., Div., Amerace Corp., Butler, N. J., has appointed *James P. Coughlin* as vice president of sales. He had formerly been divisional manager of Westinghouse Electric Corp. and assistant to the president of Eutectic Welding Alloys Corp. Coughlin succeeds *Roland Reppert*, who has been named to newly created post of vice president of marketing.

N. H. Collisson has been named operating head of the metals division of Olin Mathieson Chemical Corp., New York City. He was formerly in charge of production and engineering. At the same time, *M. L. Herzog* was appointed general manager of operations in the metals division. *John P. Anderson* has been named assistant manager of aluminum distributor sales.

Malcolm F. Judkins has been appointed technical director, commercial production engineering of Sylvania-Corning Nuclear Corp., Bayside, N. Y. He was formerly with Firth Sterling Inc.

H. C. Brown, a vice president of Chicago Bridge & Iron Co., Chicago, since 1942, has retired after 43 years of service with the organization. He will remain a member of the firm's board of directors.

Robert A. Arrison has been elected vice president for engineering of the Keleket X-ray Corp., the X-ray subsidiary of Tracerlab, Inc., Waltham, Mass.

Dr. Harry P. Kling has been named manager of the nuclear components department of The Martin Co.'s Nuclear Div., Baltimore, Md.

Died . . .

I. A. Woerner died May 23 after a brief illness. Mr. Woerner, most recently associated with Nickelson Tool & Die Co., Inc., Wichita, Kan., was a pioneer in the development of flame cutting machines. The most widely used of these machines was designed for precision cutting of plate stock and the profile cutting of pipe.

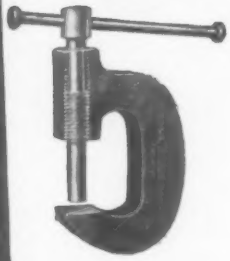
Two officers of the Rayno Distributors, Inc., Brooklyn, died within a month of each other. *George Schneider*, vice president, died May 6, and *Arno W. Biedermann*, chairman of the board and founder of the company, died June 5.

"Red Head"
WELDING CLAMPS

• Special design protects threads against spatter and damage — open or closed...

• Heat treated threads and chrome-moly handle provide long wear, resistance to bending.

• Solid plate clamp body gives extra strength, resists bending or twisting.



DESIGNED FOR WELDING
All "Red Head" Welding Clamps are designed, from actual experience, to provide efficiency and long life. Built to take abuse, they provide long and trouble-free service.

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Tempilstiks®
FOR ALL HEAT-DEPENDENT OPERATIONS . . .

looks like a crayon
marks like a crayon
tells temperatures like a precision instrument

Sixty-three different compositions enable you to determine and control working temperatures from 113° to 2000°F. TEMPILSTIK® marks on workpiece "say when" by melting at stated temperatures — plus or minus 1%.

Also available in liquid and pellet form . . . Write **Welding Sales Dept.** for sample TEMPIL® pellets . . . State temperatures of interest — please!

Tempil®
CORPORATION
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No Other Product Can Do a Galvanizing Job Like

Galvalloy

Does - *HERE'S PROOF*

Heat welded seam on galvanized sheet to 600° with Torch
Rub GALVALLOY against heated surface as shown — now spread with wire brush for a bright finish.

GALVALLOY Covers the Same Amount of Area with 1/5 the Amount of Material.

Send today for Testing Sample and you'll learn Why GALVALLOY has no equal for ANY Galvanizing Job.

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IT'S ECONOMICAL

NEW "ROYAL" HARDENING POWDER IN THE NEW SHAKER CAN

- "ROYAL" Hardening Powder is more effective than cyanide. Gives off no dangerous fumes. Simplifies the work. Economical to use.
- Makes low-grade steel perform like high-grade steel.
- Enables the weldor or blacksmith to produce a finer cutting tool without technical equipment.
- Produces a .01 to .02 in. case depth with necessary Brinnell toughness on large and small low-carbon steel tools and parts.
- Send for sample and descriptive booklet.

Manufactured only by
ANTI-BORAX COMPOUND CO., INC.
FORT WAYNE 9, INDIANA

Molybdenum

FABRICATION OF MOLYBDENUM. Published by American Society for Metals, Cleveland, 1959. Paper bound, 8½ by 11 in., 221 pages. Price, $6.50.

Book contains 18 papers that were presented at an ASM conference held in May, 1958, at Los Angeles. Much previously classified material appears in *Fabrication of Molybdenum* for the first time.

Techniques covered in this volume include forming, welding, protection and coating. Among the chapters, all written by specialists, are: Welding of Molybdenum, Development of Molybdenum Base Alloys, Protective Coating Systems for Molybdenum, Missile Structures and Powerplants, Molybdenum Requirements in the Nuclear Energy Field, Testing in the Hot Rod Engine. The fabrication of molybdenum, in particular, is thoroughly covered.

Pipe drafting

FUNDAMENTALS OF PIPE DRAFTING. By Charles H. T. Thompson. Published by John Wiley & Sons Inc., New York, 1958. Paper, 8½ by 11 in., 66 pages. Price, $3.50.

Fundamentals of Pipe Drafting is a book written for students who have accomplished the basic skills of mechanical drawing and wish to develop the specialized skills of pipe drafting.

The author is aware that the ability to do pipe drafting depends upon knowledge of several other types: machine drafting (because of large amounts of machinery and equipment involved); architectural drafting (because many piping problems involve architectural plans); and in some cases, map drafting (because pipe lines that cover large areas involve the use of maps).

Though the book is small, most of these areas are covered quite thoroughly in nine chapters and an appendix. While the author touches briefly on welding, he does point out its importance to modern industry, and the importance of welding symbols in pipe drafting.

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30 YEARS AGO

(Taken from the WELDING ENGINEER of August, 1929)

—30 YEARS AGO—

A. (Gus) Yoch helped John Murphy prepare a welding course to train pipeline weldors for Consolidated Gas Electric Light and Power Co., Baltimore.

—30 YEARS AGO—

According to a recent announcement in a Pittsfield, Mass. newspaper, this city claims to be the first to officially adopt the building code welding provisions proposed by the American Welding Society.

—30 YEARS AGO—

"Welding the Eaglerock airplane" explains in detail how fuselage and other framework steel tubing is joined by oxyacetylene welding in manufacturing a new seven-passenger cabin plane, developed by Alexander Industries, Colorado Springs, Colo.

—30 YEARS AGO—

"Building Road Machines" relates how and where R. G. LeTourneau, California grading contractor and earthmoving machinery manufacturer, successfully uses both oxyacetylene and electric arc welding methods.

—30 YEARS AGO—

N. E. Peden, master mechanic, Melton Lumber Co., Newellton, La., offers interlocking joint designs intended for modern residence construction, where strength is not dependent upon the welds.

—30 YEARS AGO—

Northern Pacific's Brainerd (Minn.) shop has successfully been utilizing arc welding to build-up locomotive driving-wheel and trailer-wheel centers for about three years.

—30 YEARS AGO—

Midwest Carbide Corp. has recently been organized by National Lead Co. and Shawinigan Products Corp. of New York, a subsidiary of the Shawinigan Water & Power Co. of Canada, for the purpose of manufacturing calcium carbide at Keokuk, Ia. This operation was previously conducted by United Lead Co.

—30 YEARS AGO—

The Lincoln Electric Co., Cleveland, is making a large addition to its present plant; approximately one-half acre more floor space will be provided. The steel superstructure will be entirely of arc-welded construction.

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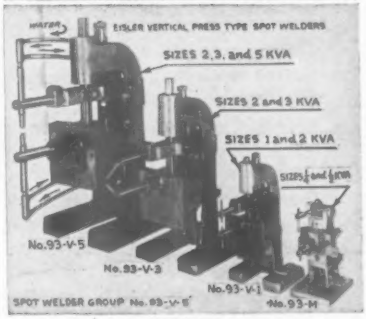

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75. PLASTIC-COATED GLOVES—American Optical Co. Bulletin S-7924 explains advantages of six different types of plastic-coated fabric work gloves. All models have curved fingers and are said to have better snag and abrasion resistance.

76. WATER SAVER—Van Vooren Products. Circular describes operation of ES-10 Water Mizer, a low cost water-saving control for resistance welding.

77. GRIND-FINISHING WHEELS — Bay State Abrasive Products Co. Flyer shows unique, two-layer construction of the wheel. Use at 30 to 45-deg angle serves for stock removal; while 10 to 20-deg angle is used for finishing.

78. COPPER ALLOY—American Metal Climax, Inc. Brochure gives properties and end uses of Amzirc alloy, consisting of high-conductivity, oxygen-free copper and carefully controlled concentrations of high purity zirconium.

79. CO_2 WELDING—Air Reduction Sales CO. ADE-882 catalog provides illustrated description of conventional CO_2 and the Dip Transfer process. Second section of manual deals with applications of the Aircomatic process; last section illustrates equipment needed for CO_2 Aircomatic welding.

80. LIQUID GAS HANDLING — Cambridge Corp. Bulletin presents advantages of liquid storing, handling and distributing of atmospheric gases by the Liqua-Guard System.

81. FLUX-CORED ELECTRODES—Arcos Corp. Bulletin-manual explains Arcosarc process using flux-cored electrodes and semiautomatic wire feed equipment.

82. R-W CONTROL—General Electric Co. Bulletin GEA-6408 describes new line of non-synchronous resistance-welding controls. Applications cover single or multiple-impulse welding by spot, projection, flash or butt method. Explains plug-in control units and ignitron contactors, and provides dimensions of various contactor and control enclosure combinations.

83. BELT GRINDERS—Abrasive Machinery Corp. Bulletin-77 gives detailed descriptions of finishing-grinders. The abrasive belt model is made in 6 types, ranging from 1½ to 10 hp, and varying from 108 to 210 lb in weight. It can be lathe, bench, or overhead-trolley mounted. An air-powered portable belt grinder model is powered by a 1½-hp air motor and uses 1½-in by 42-in. length abrasive belts.

84. INHALATION THERAPY—National Cylinder Gas. Booklet NM-116, called NCG Oxygen Therapy in Industry, was prepared for plant physicians, first aid groups and personnel management. It describes complete line of NCG apparatus.

85. PENCIL-GRIP TORCH—Tec Torch Co., Inc. Bulletin AN4/59 explains how Tec torch 4330 can quickly be converted into miniature 300-amp 45 or 90-deg angle torch.

86. THREE-PHASE WELDERS— Sciaky Bros., Inc. Bulletin 318-1 describes the SPT-2 and EPT-2 spot and projection, air operated, press type welders. Both use 3-phase, patented welding transformer.

87. VACUUM CLEANER—Clements Mfg. Co. Illustrated bulletin gives applications and construction of Model 14 Quik-Vac, electric powered industrial-type cleaner.

88. CARBIDE GRINDING WHEELS—Carborundum Co. Folder: "Carbide Grinding with Man-Made Diamond Wheels" sets forth characteristics of man-made diamonds, diamond wheel shapes, and applications.

89. EXTRUDED RECTANGLES—Ampco Metal, Inc. Extruded aluminum bronze stock rectangles for severe wear applications are described in this 4-page bulletin.

90. NUTS AND FASTENERS—McLaughlin Co. Firm's general catalog lists weld, pilot-weld, floating-weld, clinch, and floating-clinch nuts.

91. AIR CONTROL VALVES—Hannifin Co. Bulletin 234, Valve Finder, includes a method for selecting 4, 3 and 2-way directional, air control valves, as well as specifications for firm's line of valves.

92. WELDABLE IRONS — International Nickel Co., Inc. A 28-page booklet, Engineering Properties of Ni-Resist Ductile Irons, contains complete story of this new cast metal, which is claimed to combine high strength and toughness with resistance to heat, wear and corrosion. Special section points out proven applications of this weldable ductile iron.

93. ELECTRODE HOLDERS—Duro Engineering Co. Brochure illustrates complete line of electrode holders, including the new Durogon which has an alloy, high-tensile strength, aluminum body.

94. ADHESIVES HANDBOOK — Minnesota Mining & Mfg. Co. Illustrated catalog describes design concepts, typical applications and characteristics of adhesives, coatings and sealers.

95. INSPECTION OF METALS—Curtiss-Wright Corp. Data sheet explains use of B-Scan Model 425, electronic instrument with a 16-in. rectangular cathode ray tube, which is used with the Immerscope 424-A, for ultrasonic non-destructive testing. The B-Scan is primarily applicable to automatic inspection techniques.

96. FLASH-BUTT WELDER—Federal Machine & Welder Co. Bulletin Fl-58 shows new design, 10, 20 and 30 kva, flash-butt welder. Specifications and electrical data are included.

97. RESINS AND COATINGS—Narmco Resins & Coatings Co. Bi-monthly publication of firm is available without charge to engineers, designers, etc., concerned with use of sandwich construction, adhesive bonding and structural plastics.

98. BRAZING ALLOY—American Brazing Alloys Co. Data Sheet 155 gives detailed specifications on Phos Sil O, new copper-phosphorus alloy, that does not require flux on copper to copper joints.

99. HYDRAULIC COMPONENTS—Lenz Co. Company catalog contains complete data on flare fittings, pipe fittings, seal tube fittings, hose assemblies, etc.

100. COMBUSTION SYSTEM—A. F. Holden Co. Bulletin 209, "Instantaneous Heat", describes company's luminous wall combustion system for gas-fired, infrared heat-treating furnaces.

101. MAGNETIC-FLUX WELDING — Linde Co. Reprint of technical article explains industrial applications of this new method of welding mild steel.

102. BRAZE ALLOY WETTING—Wall Colmonoy Corp. Data sheet No. 2.2.3 discusses characteristics of Nicrobraz Vapo-Flux for promoting brazing alloy wetting and flow in dry-hydrogen or inert atmospheres.

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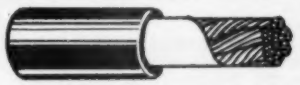

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150. Air Reduction Sales Co.—"Aircomatic CO_2 Welding," 24 page catalog available.

151. Alloy Rods Co.—Bulletin AR-102 available on "Arcaloy" stainless steel electrodes.

152. All-State Welding Alloys Co.—Instruction manual available and name and address of nearest distributor.

153. Aluminum Co. of America—Write for information on aluminum welding and brazing processes and a loan of films on joining aluminum.

154. American Pullmax Co., Inc.—Catalog on Metalworking ideas and sound films available.

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158. Bay State Abrasive Products Co.—For ideas in grinding problems send for the name of the "Bay State" distributor nearest you.

159. Becker Brothers Carbon Co.—Catalog on "Keen-Cut" electrodes carbon rods and plates, welding paste, graphite cores and chills and graphite powder available.

160. Blickman Inc.—Write for technical bulletins on various types of welding enclosures.

161. Carol Cable Co.—Further information available on Carol's "Dynapower" welding cable.

162. Chicago Boiler Co.—Complete details on the "Red Head" welding clamp.

163. Columbia Electric Mfg. Co.—Write for illustrated catalog on "Tong Test AC-DC Ammeter.

164. Contour Sales Corp.—Information on "Curv-O-Mark" pipe layout tools, for marking pipes and structural angle cuts of any type.

165. Coyne Cylinder Co.—Write for folder on Coyne's acetylene cylinders.

166. Curtis-Wright Corp.—Literature available on Radiographic equipment manufactured by Curtis-Wright.

167.—Dockson Corporation—Catalog 56-06 on Dockson's protective helmets available.

168. Duro Engineering Co.—Further information on the Duro "Standard" holder and the "Durogan" tong-type holder.

169. Eastman Kodak Co.—Folder, "13-minute processing for industrial x-ray films" available and name of your local dealer.

170. Eisler Engineering Co., Inc.—Catalog 93-57 on spot and wire butt welders and the vertical type press welder.

171. Eutectic Welding Alloys Corp.—Further information available on Eutectic's low temperature welding alloys.

172. H & M Pipe Beveling Machine Co.—Illustrated catalog sheets on pipe cutting and beveling machines manufactured by H & M are available.

173. Harnischfeger Corp.—Further information available on the P & H portable welders.

174. Hobart Brothers Co.—Write for more information on the Hobart welders best suited for your work.

175. Hobart Brothers Co.—Samples of the new "10 ip" electrode available and catalog on complete line of other welding electrodes.

176. International Nickel Co., Inc.—Booklet, "Inco Welding Products" gives technical data on Inco nickel alloys.

177. International Nickel Co., Inc.—Booklet, "Now You Can Weld Dissimilar Alloys Quickly and Easily" explains how problem welds were solved with Inco-Weld "A" electrodes and wire.

178. Invincible Vacuum Cleaner Mfg. Co.—Send for folder on Invincible Flux Recovery Systems.

179. Jackson Products—Write for further information on Jackson's electrode holder, ground clamp, welding helmet and safety cap.

180. Leach & Garner Co.—Technical Data Sheet No. 501 available on silver brazing alloys.

181. Lenco, Inc.—Further information available on a new method of connecting welding cable.

182. Lincoln Electric Co.—Write for further data on Lincoln's "Faceweld 12" electrode for hardsurfacing.

183. Linde Company—Further information available on the new "Mighty Midget" welder.

184. Linde Company—Information on "Oxweld" goggles and gloves and name and address of your nearest Linde distributor.

185. Lummis Mfg. Co.—Write for further information on "Key-Bak" key reel for your weldors.

186. P. R. Mallory & Co., Inc.—Chart available, "Do's and Don'ts for Resistance Welding."

187. The Merit Co.—Write for further information on the "Merit Might Midget" portable spot welder.

188. Merrill Brothers—Information available on material handling devices.

189. Metalloy Products Co.—Testing sample of "Galvalloy" available for your galvanizing job.

190. Miller Electric Mfg. Co., Inc.—Complete particulars will be sent on the Gold Star SR rectified type welder.

WELDING INFO-AIDS

USE THIS CARD for Literature, Catalogs, and Bulletins shown on preceding pages and for those featured in this month's ads as listed opposite and on following page

Also information about

NEW PRODUCTS described on pages 54 to 62

Every month WELDING ENGINEER lists many new catalogs and bulletins available from manufacturers. All are yours for the asking. However, this service is valuable to you only if you use it.

USE POSTPAID CARD →

★ For copies of any manufacturers bulletins described on these pages circle the number of the items on card at right. Fill in your name, title, company and address. This has to be done only once on either post card. You need no postage.

★ For additional information on New Products described in this issue, circle the numbers of the items that interest you. The New Products section begins on page 54.

WARNING!

Illegible or incomplete addresses may keep you from receiving the information you desire. And remember, cards postmarked after the deadline date cannot be processed.

★**Post card not valid after three (3) months. After that, write *directly to the manufacturer*, describing fully the information and/or literature wanted.**

Name_____ Title_____

Company_____

Address_____

City_____ State_____ 8/59

NOT GOOD AFTER NOVEMBER 1, 1959

WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill.

Please send me without obligation further information about the following:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
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BUSINESS REPLY CARD

First Class Permit No. 32, Morton Grove, Ill.

Welding Info-Aids,
Welding Engineer
P.O. Box 28
Morton Grove, Ill.

Literature offered in ads

(Continued from page 72)

191. National Carbide Co.—Information on calcium carbide and name and address of your nearest distributor.

192. National Welding Equipment Co.—Further information available on cutting tips with 3 internal cone seating surfaces.

193. Page Steel & Wire Div.—Folder containing information on submerged arc and inert gas automatic welding wire, and chart is available.

194. Phelps Dodge Copper Products Corp.—Write for further information on Phelps Dodge "Habirprene" arc welding cable.

195. Phoenix Products Co.—Write for new folder "DryRod as Standard Welding Equipment."

196. J. M. Ragle Industries Inc. Further information available on "Commando" rods, and other "Commando" products.

197. Riegel Textile Corp.—Catalog available on Riegel gloves.

198. Ronan & Kunzl, Inc.—Write for further information on storage and transport containers.

199. Ruemelin Mfg. Co.—Information available on the Ruemelin fume collector.

200. Shawnigan Products Corp.—Further information on calcium carbide available and name of your local distributor.

201. Shoot-A-Lite Corp. — Literature on "Safety Gas Liter" for welding and cutting torches.

202. Sight Feed Generator Co.—Write for complete information on the "Rexarc" automatic flux circulating unit.

203. Stoody Co.—Literature available on Stoody hardfacing rods for use on big equipment.

204. Stulz-Sickles Co.—Write for complete details on "Manganal" bare welding electrodes and name and address of your nearest distributor.

205. Tec Torch Co., Inc.—Further information available on the Tec Vycor gas nozzle.

206. Tempil Corp.—Write for sample Tempil pellets and information on Tempilstiks.

207. Tennessee Fabricating Co.—New catalog on over 400 casting designs, tubing, welding rods and machine tools and supplies is available.

208. Thermacote Co.—Send for a free Thermo Spiral Tip Cleaner and further information.

209. Tuffaloy Dept., Air Reduction Sales Co.—Catalog and prices on Tuffaloy spot welding tips, tip holders and adapters.

210. Tweco Products Co.—Write for free Twecolog showing the complete line of Tweco accessories.

211. Unique Equipment Inc.—Write for detailed catalog and descriptive literature on Unique equipment.

212. United Specialties, Inc.—Full information on "Weldreel" hose and cable reels sent on request.

213. Victor Equipment Co.—For precise control and measurement of gases write for additional information on Victor regulators and Victrometers.

214. Victor Equipment Co.—"Victor Hardfacing Manual" explains how to apply Victor hardfacing alloys to wearing parts.

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Welding Engineer
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Name_____ Title_____

Company_____

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City_____ State_____ 8/59

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DOWN-TO-EARTH FACTS *about electrode holders*

A vital link in an arc welding circuit, the electrode holder performs several functions. Its jaws must have a powerful bite on various sizes of electrodes. Its design must let the weldor change rods quickly, be comfortable to handle and run cool within its rated amperage. It must have an easy, quick, efficient means for attaching the welding cable. Its insulation must withstand tremendous heat and impact.

Only **TWECOTONG ELECTRODE HOLDERS** *offer all these features:*

Super-Mel Insulation. Won't Break, Won't Burn, Won't Char.
All parts are replaceable.
Tong type, easy to change rods. Runs cool.
Powerful rod grip. All position.
Attach Cable in two minutes with Ball-Point Connection.

TWECO GROUND CLAMPS

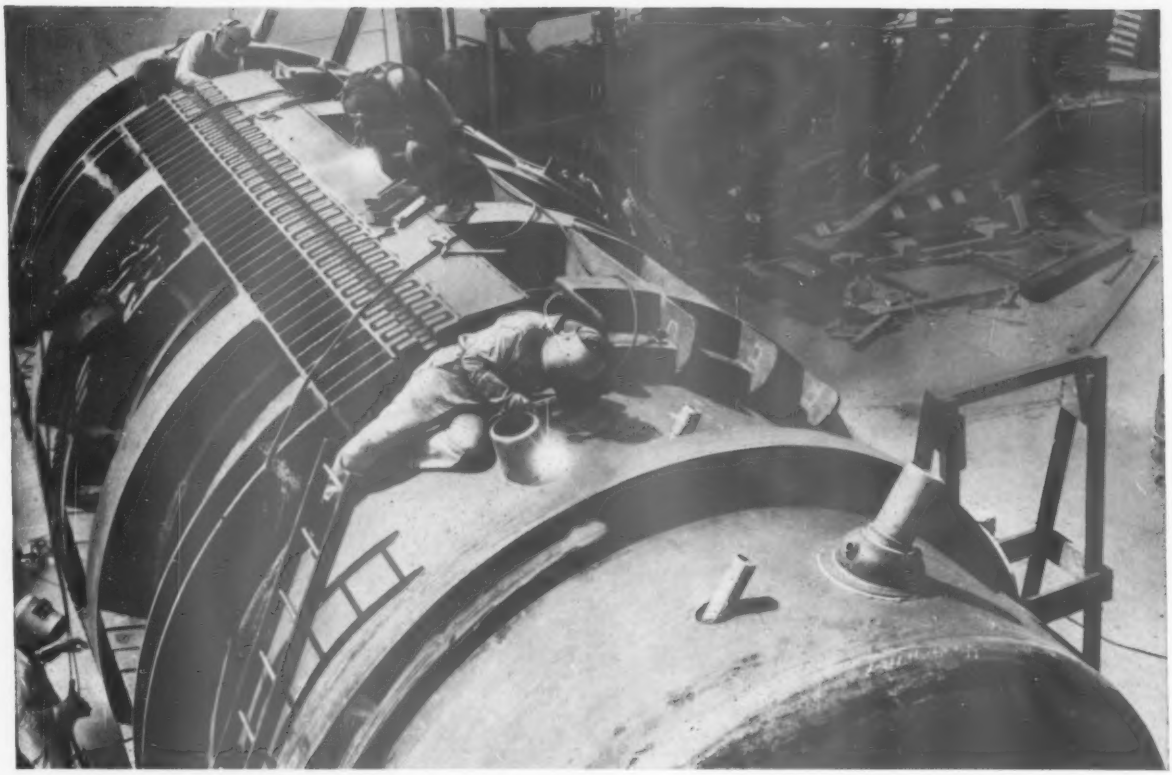
WRITE FOR FREE TWECOLOG SHOWING THE COMPLETE LINE OF TWECO ACCESSORIES

TWECO CABLE CONNECTORS

MANUFACTURERS: ARC WELDING ELECTRODE HOLDERS, GROUND CLAMPS, CABLE CONNECTORS, TWECO-LITE ALUMINUM WELDING CABLE

TWECO PRODUCTS, INC.

P. O. BOX 666 • Factory: Boston at Mosley • Phone AMherst 5-1684 • Wichita 1, Kansas



Inco-Weld "A" Electrode joins high-strength low-alloy steel and 304 stainless, in 45 ft by 12 ft diameter pressure chamber. Fabricated by O. G. Kelley and Co., Boston, Mass.

Inco-Weld "A" joins most dissimilar alloys in nuclear applications, too

The 4 weldors above are all using Inco-Weld* "A" Electrode. They're welding high-strength low-alloy steel *and* 304 stainless on a 160-ton nuclear components testing chamber.

Two other popular electrodes failed on test welds for this job . . . weld metal cracked from differing thermal expansion rates between the dissimilar metals joined.

Inco-Weld "A" Electrode solved this problem . . . produced X-ray quality weld throughout; with corrosion resistance equal to parent metal.

Better than 97% of *all* weldable dissimilar alloys can be joined with both Inco-Weld "A" Electrode and Inco-Weld "A" Wire. You don't need any special equipment or training to get sound, strong. corrosion-resisting welds.

Useful new booklet "Now You Can Weld Dissimilar Alloys Quickly and Easily" includes actual cases of problem welds solved; costs reduced; with Inco-Weld "A" Electrode and Wire.

*Registered trademark

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street — New York 5, N. Y.

MIG or TIG-Weld dissimilar alloy combinations with Inco-Weld "A" Wire.

You get all the advantages of Inco-Weld "A" Electrode plus an age-hardenable deposit. Available in spools and cut lengths.

INCO WELDING PRODUCTS

electrodes • wires • fluxes